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# INTRODUCTION

## 1.1 OVERVIEW OF STRESS DETECTION IN SPHYNX CATS

Stress in cats is an essential problem for veterinarians and cat owners since it can lead to various health issues like impaired immune function, behaviour disturbances, and chronic illness (Overall, 2005). Cats do not easily express their pain and distress, so timely diagnosis of stress in them is vital for their health. Traditional stress detection techniques, such as physiological monitoring and observation of behaviour, can be inconsistent and subjective (Steagall, 2017). Thus, more effective and unbiased means need to be adopted to promote early intervention and better feline well-being.

Among other domestic cat breeds, Sphynx cats have physiological characteristics in their own right that render the identification of stress interesting. Unlike other breeds, Sphynx cats lack fur, an element that has a significant impact on their thermoregulation. Without the insulating coat, their body temperature fluctuates more readily to adapt to changing environmental conditions and stressors (Olivry, 2017). Studies indicate that stress can induce nanoscale temperature changes in cats, making body temperature a useful biomarker for tracking their health (Quimby, 2016). Based on these factors, Sphynx cats would be an ideal model organism to study AI-based stress sensing systems, and specifically thermal and biometric sensing.

The ability to correctly recognize stress in Sphynx cats is critical for breeders, pet owners, and veterinarians. Stress recognition at an early stage allows proper interventions, including manipulation of the environment, modification of care procedures, or providing medical assistance where necessary (Stella, 2013). Traditional veterinary consultations cause additional stress on cats hence the test results could be biased, making home-based monitoring systems a more practical alternative. Through the use of sophisticated technology, stress detection can be more accurate and accessible, ultimately improving the general quality of life of Sphynx cats and other breeds of felines.

## 1.2 IMPORTANCE OF AI IN PET HEALTH MONITORING

The Animal and Veterinary Innovation Agenda outlines the centre’s commitment to fostering innovation in veterinary medicine while addressing emerging challenges. This includes developing AI/ML-driven tools for antimicrobial resistance research, genome editing safety, and post-marketing safety surveillance. The paper discusses the CVM’s participation in the FDA’s role in shaping guidance documents for AI in regulatory decision making (Res, 2025).  AI revolutionizes animal nutrition by optimizing feed formulations and analysing intake parameters. In terms of health management, AI systems integrate sensors, analytics, and knowledge bases to enable continuous monitoring, disease prevention, and prompt diagnosis. The review also explores how AI can transform housing environments through automated adjustments and real‐time data‐driven cleaning. Furthermore, it emphasizes the contributions of AI in predicting potential disease outbreaks by identifying patterns from extensive datasets. (Health, 2023).

While traditional stress detection methods often rely on subjective observations or sporadic veterinary assessments, AI-driven stress detection can continuously monitor an animal’s physiological signals like heart rate variability, body temperature, and movement patterns (Binuni, 2024). Such systems examine data patterns through machine learning algorithms to discern early precursors of stress so that proactive interventions occur before serious health issues emerge. Such advances in technologies such as this will be beneficial for breeds such as the Sphynx cat whose stress indicators are more closely associated with thermoregulation.

A collar-based AI system presents an effective and new way to sense stress in Sphynx cats. Wearable technology has exhibited a growing trend as a method through which to monitor health in humans and animals alike, continuing to allow some form of non-invasive or intrusive, real-time data collection (Ashley. M, 2022). With the aid of AI-enabled sensors, a smart collar can constantly monitor key physiological characteristics that heterotopically indicate stress, including body temperature, heart rate, and activity levels. The data gathered could then be analysed for (the detection of patterns) (insert here what you want in place of ‘patterns’) that indicate stress, thereby alerting pet owners or veterinarians regarding any potential further in-depth investigations required.

AI-based stress detection, however, is best done through a collar system which holds ease, efficiency, and reliability. It provides, unlike invasive procedures, or infrequent veterinary check-ups, continuous monitoring without spoiling the comfort of a cat. Artificial intelligence (AI) is a fast-paced technological advancement in terms of its application to various fields of science and technology. In particular, AI has the potential to play various roles in veterinary clinical practice, enhancing the way veterinary care is delivered, improving outcomes for animals and ultimately humans (Olalekan.C.A, 2024). This technological advancement creates a double win for both the cat and the owner: better management of feline health and a larger space for proactive care and intervention that strengthens the bond between pets and their owners.

The incorporation of AI into pet health monitoring truly paves pathways toward better animal care and veterinary excellence. AI-enhanced stress detection surely brings cats the world of better chances with kinds of a kit for owners, helping to keep Sphynx cats in the pink of their health.

# 2.0 RESEARCH PROBLEM, QUESTIONS & OBJECTIVES

## 2.1 RESEARCH PROBLEM

Gap in existing research

The pet health care sector, particularly the detection of stress in cats, lacks high-tech technological solutions that provide real-time, data-based insights. Current methods of stress detection in cats are primarily behavioural observation-based, which is subjective and not necessarily accurate. There is also a significant gap in AI-driven temperature analysis-based pet stress detection, even though it is scientifically well established that body temperature changes are associated with stress responses in animals (Croney, 2019).

Lack of Real-Time, AI-Based stress detection Tools for Cats

Current approaches to stress detection in cats are mostly dependent on human observation or tardy veterinary evaluation, which tends to miss early signs of stress (Hyg., 2022). Such approaches are reactive rather than proactive and render timely interventions before stress becomes a problem more challenging. AI-powered tools have the potential for ongoing, real-time monitoring, thereby enhancing early detection and enabling prompt interventions to enhance the well-being of a cat (Yammouri, 2024).

Existing Solutions Rely on Behavioural Observation, which is Subjective

Traditional approaches to ascertaining feline stress rely on the observation of behaviours such as hiding, aggression, or hyper grooming. These must be interpreted by pet owners or veterinarians, and it introduces subjectivity into the recognition process. Because of variations between individuals in the interpretation of the same behaviour, the resulting stress assessments may be inconsistent and lead to delayed diagnosis or delayed intervention (Leij, 2019).

Lack of Temperature-Based AI Analysis in Pet Healthcare

Whereas thermal imaging and temperature monitoring are increasingly common in veterinary medicine, AI-supported real-time analysis for the detection of stress in companion animals is still an untapped area (Travain, 2016). Such AI solutions could potentially leverage temperature information to identify fluctuations in the degree of stress being suffered by a cat, offering more precise and dependable determinations than can be achieved through the observation of behaviour alone. AI-powered temperature analysis is, however, an uncharted territory in this field ((Basel)., 2023).

Impact of this problem

Late identification of stress in cat’s results in chronic health problems, like immunosuppression and gastrointestinal illness, since unrecognized stress worsens underlying health over time (CA Tony Buffington, 2020)). Failure to intervene early usually results in the costlier veterinary treatment in the future, as advanced health problems arise that need lengthy treatment (Bridgette Bain, 2022). Furthermore, chronic stress considerably lowers the quality of life for the cat, causing physiological and psychological distress, which may result in behavioural changes and decreased performance in normal activities (Mills, 2014). Management of stress would not only enhance the well-being of a cat but also lower pet owners’ expenses.

## 2.2 RESEARCH QUESTION

1. **How can AI be used to detect stress levels in Sphynx cats based on body temperature?**

AI can contrast real-time temperature from a smart collar to identify stress in hairless Sphynx cats, whose skin makes it easier to sense temperature fluctuations compared to other fur-bearing breeds. Machine learning under supervision compares live temperatures against a baseline (rest state) in order to flag up abnormalities such as hyperthermia due to stress. For example, if the temperature of a cat increases when there is thunderstorm weather, the AI classifies this as a stress response. Challenges are to take into account environmental conditions (e.g., room temperature) and avoid false positives from non-stressful stimuli for example play. Earlier research (Travain, 2016) confirms that infrared thermography is a valid technique to detect stress in animals, as this research substantiates.

1. **What are the key indicators of feline stress that AI can analyse accurately?**

Apart from temperature, AI processes multimodal data like HRV, movement, and vocalizations to increase accuracy. For instance, nervous cats will display heightened HRV (recorded using PPG sensors), pacing/freezing (tracked using accelerometers), or shrill meowing (processed using audio ML algorithms). By combining these streams of data, the AI reduces false positives. For example, distinguishing exercise induced panting from distress. However, synchronizing streams of data and ensuring sensor accuracy (e.g., minimizing motion artifacts in HRV recordings) remain issues. Research (Williams, 2022) validates HRV as a stress marker, and recent research (Schlosser, 2020) demonstrates the ability of AI to decode cat vocalizations.

1. **How can the SphynxSense application provide real-time insights to cat owners?**

SphynxSense app translates AI-processed data into on-demand notifications and actionable suggestions to the owners. For example, if the collar detects a surge in stress, the app can notify: “Fluffy is stressed move her to a calm room.” It also plots trends (e.g., weekly stress trend) and suggests interventions (e.g., calming pheromones) based on past success. To offer velocity, edge AI computes on the collar itself, yet cloud backups hold long-term health tracking. Of note is balancing battery life with real-time capability, considering constant transmission of Bluetooth/Wi-Fi reduces power. Other pet wearables (e.g., FitBark) use similar frameworks (L Kogan, 2009).

1. **What are the technical, legal, and ethical considerations of AI-based pet monitoring?**

AI pet monitoring raises privacy, consent, and bias issues. Legally, questions arise over who owns a cat’s health data owners, developers, or vets and compliance with GDPR like regulations for anonymizing data. Ethically, pets cannot consent to surveillance, and over-monitoring may stress owners (e.g., constant alerts). AI bias is another risk, models trained mostly on indoor cats might misclassify outdoor cat’s behaviours. Solutions include transparent data policies and opt-out features (Med., 2009).

## 2.3 RESEARCH OBJECTIVE

1. To develop SphynxSense, an AI-driven app that detects Sphynx cat stress levels using an intelligent collar device.

This research objective is to develop SphynxSense which is an AI-driven app that can detects Sphynx cat stress levels by using an intelligent collar device. This objective is to design a wearable collar with embedded thermal and biometric sensors. It also to train machine learning models to recognize stress patterns from collected data (L Kogan, 2009).

1. To design an intuitive and user-friendly UI for SphynxSense, ensuring ease of interpretation.

This research objective is to develop a mobile app with clear visualizations such as stress level graphs and alerts. This being develop is to ensure the user to be more understanding about the result and also accessibility for pet owners with varying technical expertise (L Kogan, 2009).

1. To integrate AI algorithms into the collar sensor system, enabling real-time stress detection.

This study focus aims at the deployment of edge computing to achieve on-device data processing for the purpose of enabling real-time, low-latency analysis. By allowing real-time processing onboard the collar sensor, it is now feasible to immediately detect pet stress signals from the system without uploading data to third-party servers, which ensures low response delay as well as reduced reliance on network connectivity. This approach ensures faster decision-making and faster response to behavioural or physiological change in a pet. Additionally, through the inclusion of AI models in this approach, there is the additional ability for continuous optimization, both increasing the accuracy as well as the efficiency of stress detection with the passage of time. Because the system is learning from actual-time input, it is capable of adapting to the unique patterns seen with individual animals and therefore provide more individualized and precise stress assessments. The goal is to have the system not only faster but also extremely accurate, providing owners with the accurate information regarding their pet’s health, leading ultimately to more informed decisions in keeping track of their pets’ stress levels (Grigg, 2014).

1. To evaluate the effectiveness of the AI-based system using a quantitative data approach.

This research objective is to conduct controlled experiments with Sphynx cats that under varying stress conditions. It also will compare AI predictions with veterinary assessments to validate accuracy and make the user to trust the result with valid data (Stella, 2013).

# 3.0 LITERATURE REVIEW

Prior studies have indicated that the overall health of sphynx cats is significantly impacted by their stress levels. Physiological markers such as variations in body temperature, heart rate, and cortisol levels, as well as behavioral markers like hiding, aggression, and excessive grooming, are commonly used to assess stress indicators in cats (CatsMe!, 2024). Since the stress level of sphynx cats is influenced by several factors, including physiological monitoring techniques, this literature review investigates how it functions as the dependent variable (DV).

Temperature has been highlighted as a key physiological indicator of stress, with studies indicating that fluctuations in body temperature correlate with increased stress levels in cats especially sphynx cats and altered patterns of peripheral blood flow (Herbon, et al., 2018).

Despite this, traditional stress measurement approaches usually rely on subjective and variable observational methods. A growing number of people are interested in AI-driven monitoring systems (Al-Atawi , et al., 2023) that use temperature as a stress indicator because of this shortcoming.

This literature reviews also the current research and technological advancements that emphasize the roles of microchip or biosensor AI, temperature-based stress monitoring and pet monitoring technologies as the independent variable (IV).

## 3.1 DEPENDENT VARIABLE (DV): SPHYNX CATS STRESS INDICATORS

The dependent variable refers to the factor that is measured or evaluated in an experiment and is influenced by another variable. In numerous psychology experiments and studies, the dependent variable often reflects a specific behavior aspect. For example, in examining how sleep influences test performance, the dependent variable would be the performance on tests (Lustik, 2024).

The sphynx cat is recognized by her large ears and wrinkled, hairless skin, and the striking medium-sized cat (Hillspet, 2025). The Sphynx cat’s bone structure and muscles are visible to everyone due to its lack of fur. It is a very strong cat with graceful, long lines (Purina, 2025). Sphynx cats are intelligent and playful pets. They love spending time with people including dogs and enjoy cuddling under blankets and they are an affection and loving breed (Flowers, 2024).

Since Sphynx cats have unique physical and behavioral characteristics, it’s critical to recognize signs of stress in these animals especially Sphynx cat (Canin, 2018). Due to stress cats can have a detrimental effect on one’s health and general well-being influenced upon mood, it is essential to accurately identify and manage it. The type, amount, and duration of the stressors, as well as the person’s biological vulnerability including genetic and constitutional factors, psychosocial support, and coping mechanisms, all impact the relationship between psychosocial stressors and illness (Schneiderman, et al., 2005).

Behavioral changes are primary indicators of stress in cats. The common signs of behavioral changes are excessive grooming or appetite loss are caused by increased aggression or excessive hiding (Protection, 2025). This also causes issues with the litter box for cats. Crying, yowling, or meowing overly. Hissing and biting are examples of aggressive behavior directed at other cats or even their humans (Rhemu, 2025).

In sphynx cat, their increased sensitivity to environmental changes may make these behaviours more obvious. Since the cat are lack of fur, they are sensitive to temperature. Because of their sensitivity to cold, they might need extra warmth in the winter and extra cooling measures in the summer (RoyalVelvets, 2025).

According to previous studies, have identified cat stress level to be aware as a critical factor of a cat well-being. This can cause from several situation such as having a new smell, new person or babies or disruption in cat’s routine or even construction and storms also can cause stress in cats (Purina, 2018). Changes in environment of the cat either arrival of a new household member or a change in the daily routine. Poor human and cat relationship either the owner lack of knowledge with the cat behaviour or inappropriate socialisation and inter cat conflict where causes occur by introducing or reintroducing of a new cat will cause problem and lead to stress (Amat, et al., 2015). In some case, stress can sometimes make it difficult for animals to behave as usual, they may hide for extended periods of time, play less, or show less curiosity (Amat, et al., 2015).

According to other studies there are several ways to identify cat stress levels. Firstly, by understanding cat body language, facial expressions, vocalizations and tail movements. One example of cat behavior explained that related with our topic is about the sign of the cat frustrated.

Cat might be frustrated experience in long term, at a lack of stimulation, such as not being able to communicate, to hunt, or they may be actively frustrated at a short-term specific event, such as not being able to reach their favorite toy. Longer-term frustration in cats can frequently be misinterpreted, so it’s crucial to discuss it with your veterinarian. The symptoms of frustrated cat behavior are that a cat that is frustrated will typically pay close attention to what is frustrating and will do whatever it takes to get what they want. The eyes will be wide open, the pupils will be dilated, the ears will be forward, and the whiskers will be spread and pointing forward and may pace impatiently (Purina, 2025).

Here is an illustration of the frustrated cats based on the studies:



Figure 1 Example of a frustrated cat (Purina, 2025)

In addition, to physiological indicators changes in body temperature, heart rate, (Togoe & Minca, 2024) and cortisol levels (Wojtas, 2023), stress in level cats is frequently measured by behavioral indicators as mentioned above like aggression behavior, elimination problems and hiding (Amat, et al., 2015). The dependent variable (DV) in this study is cat’s stress levels are impacted by number of variables including physiological monitoring methods.

There are differences in hair cortisol level in cats with and without stress by comparing with sexes for indoor and outdoor and cats living in single or multi cat’s household. The studies found that cats with higher hair cortisol levels have behavioral problems, especially stress problems caused by eliminating outside the litter box or aggressive toward household members. Cats that are under a lot of stress may interact with people and other cats. The studies show that 16% of cats housed more often showed inappropriate behavior rather than outdoor cats such as acting aggressively towards their owner or other animals and increased night activity, 32% got outside the litter box markedly as higher cortisol level (Wojtas, 2023).

Studies have shown that changes in body temperature are associated with higher levels of stress in cats. This shows that during exercise, heat stress disrupts these homeostatic processes lead to hyperthermia or hypohydration in body when a rise in body temperature and loss of body water through sweating occurs by exercise in the heat (Periard, et al., 2021). Climate changes are a global problem and the effect of heat stress that require long periods of several weeks to adapt with the temperatures. Sweating, panting and an increase in heart rate were considered as the physiological response in animals subjected to heat stress, especially in cats (Togoe & Minca, 2024).

This makes temperature one of the primary physiological indicators of stress. However, observational techniques which can be random and inconsistent are frequently used in traditional stress measurement methods. Example stress measurement methods use by farmer to cows is by using the Infrared Thermography (IRT). IRT is a non-invasive method for monitoring temperature. It is not mainly used in real time but mainly used to measure the amount of heat stress that people experience using implantable microchips, remote sensing technologies or ear canal sensors. This method could be used as indicators for stress reactions because 60% of heat disappears in the infrared range (Togoe & Minca, 2024). Greater emphasis on AI-based monitoring systems that use temperature as a stress indicator has resulted from this difference.

Cats’ physiological reactions to stress include raised cortisol levels, changes in body temperature, and an accelerated heartbeat. Temperature monitoring is an essential part of stress measurement because Sphynx cats’ lack of fur may cause more obvious or extreme temperature shifts whether it is too cold or hot.

## 3.2 INDEPENDENT VARIABLE 1: MICROCHIP/BIOSENSOR AI

An independent variable is variable which is not influenced by any other variables, and you can manipulate in an experimental study to explore its effect. Independent variable is also known as an outcome variable that explains an event and is used to predict the value of dependent variable (Bhandari, 2023).

Powered by artificial intelligence, microchip and biosensor integration (IV) played a crucial role has transformed veterinary medicine, clinical examination, diagnosis and treatment for both human and animal by providing non-invasive, real-time animal health parameter monitoring allowing for early detection potential (Albadrani, et al., 2024).

A simpler replacement for traditional methods, temperature-sensing microchips have been created to track cats’ body temperatures. The traditional methods are using the Rectal Temperature measurement (RT) which cause stress and defensive behavior has replaced the subcutaneous temperature sensing identification microchips that offer to measure subcutaneous temperature (MT) (Candy, 2024). According to the study, they conclude that using MT potentially offers a less stressful and more convenient and comfortable to assess body temperature in cats rather than use RT to measure temperature can cause stress and other problem especially in cats (Goig, et al., 2024).

Other studies that also use machine learning to determine core temperature for cats agree that by using this method to replace direct measuring RT for cats that causes stress can detect the change of the body temperature of an animal and animal health (Zhao, et al., 2024).

By creating signals appropriate to the concentration of an analyte in the reaction, a biosensor is a device that measures chemical or biological reactions. Applications for biosensors include drug discovery, disease monitoring, and the detection of disease markers in bodily fluids like sweat, urine, blood, and saliva (Bhalla, et al., 2016) not only in human beings but also in animals. When combined with machine learning, wearable non-invasive biosensors can facilitate remote monitoring, diagnosis, and treatment for a broad range of medical conditions and biomedical research (Islam & Washington, 2024).

Since our product SphynxSense application and collar are used to detect temperature and stress, to commercial use AI integration in biosensor (IV) many products on the market nowadays are commercial use of deep learning models for biosensing. For real example, that similar with our neck collar SphynxSense is according to the previous study, implement wearable wireless biosensor technology for monitoring cattle. The neck collar sensor system is devices with sensors hanging on a cow’s neck and widely used to control the amount of feed. The neck collar strap has accelerometer and microphone sensors to detect the temperature of animal body and measuring eating time and activity level (Mingyung & Seongwon, 2021).

The biosensor is usually used in large farming but is not suitable for chicken and fish to detect stuff such as blood, gender identification or infectious disease and detect body temperature in animals. Using biosensors to detect the body temperature of animals is the most crucial parameter for assigning heat stress to associated with health, wellbeing and reproductive success (Koelmen, 2021).

Maintaining your pet’s heart rate variation is like keeping an eye on your own Heart Rate Variability (HRV). Thanks to ECG biosensors, the pet’s collar is fitted with a wearable gadget that continuously gathers vital sign data such as illness like heart disease or when they are stress. By implicating biosensor technology devices, owners help give their pets quality of life (Biosensors, 2017).

## 3.3 INDEPENDENT VARIABLE 2: TEMPERATURE BASED STRESS MONITORING

Since stress, a common mental health issue, is frequently overlooked. Conventional assessment techniques rely on self-reporting, which can be unreliable, and lack real-time monitoring. The suggested system incorporates AI algorithms that accurately identify, evaluate, and create an AI-powered system for tracking and evaluating user stress levels (Kaushik, 2023).

One of the most important physiological markers of stress in cats is body temperature. Cats have been known to experience stress induced or hyperthermia, which is defined as a high body temperature without an infection (Quimby, 2016). AI-enhanced temperature-based monitoring systems or using AI based wearable sensors can recognize moment shifts in temperature that could indicate stress reactions in real time health data of patients. Thus, by using machine learning (ML) and AI algorithms can provide individual health status or issues can be personalized and accessible (Shajari, et al., 2023) not only for humans, including the animal.

Monitoring cat’s health is crucial to the early identification of possible health problems and making sure they get the care they require as quickly as possible. Tracking their health over time to identify any changes that may require attention is known as continuous health monitoring. One of the most widely used solutions for continuously checking on your cat’s health is wearable collars and tags. Other than that, by maintaining an eye on your cat’s health it is now easier by using health monitoring apps that gather all the data in one useful location. With just a few phone taps, you can control every aspect of your cat’s health thanks to features like these (Mitchell, 2024).

The term artificial intelligence (AI) refers to the creation of computer systems that can perform tasks that typically require human intelligence, such as language translation, visual perception, and decision-making. The use of statistical models, algorithms, and machine learning techniques to enable machines to learn from data and slowly enhance their performance is known as artificial intelligence (AI). Numerous applications of AI are currently being used in healthcare, including contact tracing applications like proximity information, early disease detection, diagnostics, medical imaging, drug discovery, monitoring, and response, as well as cost reduction, improved patient outcomes, and increased efficiency (Rehman , et al., 2024).

The advantages of using AI to measure temperature-based stress monitoring

By implementing AI integration to measure temperature-based stress monitoring there a several potential benefits:

* Enhanced personalized care to early disease detection
* Real time monitoring of vital signs
* Improves diagnostics accuracy and efficiency on analysis
* Enhanced patient engagement involves their own health management (Falkner, 2025)

The challenges faced by implementing biosensors

These systems provide ongoing observation, giving a thorough picture of a cat’s stress levels over time. To achieve accuracy, higher sensitivity, selectivity and dependability towards specific biomolecule sensing, (Shajari, et al., 2023) more research is necessary to address issues like individual variability and environmental influences on temperature readings.

## 3.4 INDEPENDENT VARIABLE 3: PET MONITORING

Pet health technology includes devices tools that can track easier for you to keep an eye on and take better care of your pet. Pet gadgets have become more and more popular because they make it possible to continuously monitor important health metrics like heart rate, temperature, activity level, and even sleep patterns (Unlimited, 2025).

Technologies for tracking various aspects of animal behavior and health are increasing in the pet care sector. Wearable sensors and smart collars are examples of devices that monitor physiological metrics, location, heart rate, body temperature measurement, disease detection and activity levels of animal. This helps to understand, improve prevention and support animal health and life (Maharajpet, et al., 2024).

For real example of devices such as Fitbit and Apple offer capabilities for monitoring heart rate, sleep, stress level, skin temperature and activity levels through methods that integrate deep learning and provide personalized health recommendations (Mehta, 2024). Based on Oura Ring monitoring nightly variations in heart rate, can track how their autonomic nervous system reacts to their daily activities and indicate stress and mood disturbances (Olawade, et al., 2024). These products are used to describe common sensor modalities used for biosensing and demonstrate how to detect examples like stress or heart rate monitors and as psychological research and effective computing for selecting biosensor with deep learning EEG (Islam & Washington, 2024). These devices can predict health problems, including stress, by analyzing data trends when AI is integrated.

Despite their potential, issues with data accuracy, pet wearable device comfort, and the moral application of gathered data are still common. AI is also making it easier for pet owners to monitor their health. Like human fitness trackers, wearable technology monitors a pet’s activity, sleep habits, and even vital signs like temperature and heart rate. These wearables analyze data using artificial intelligence (AI) to provide insights into a pet’s health, potentially allowing its owner to identify problems early (Akash, 2025).

# 4.0 PROBLEM ANALYSIS

Developing an AI-based stress detection system for Sphynx cats necessitates a thorough examination of various external and internal factors that could influence its success. This analysis encompasses a PESTLE assessment, a SWOT analysis, an industry evaluation including customer demand and competitive forces, and a target market analysis that considers demographic, psychographic, behavioural, and geographic factors.

## 4.1 PESTLE ANALYSIS

The political and legal environment plays a pivotal role in the development and deployment of veterinary technologies. Regulations concerning animal welfare, data privacy, and medical devices vary across jurisdictions, posing challenges for market entry and compliance. For instance, in the United States, while the Health Insurance Portability and Accountability Act (HIPAA) does not cover animal records, veterinary clinics must adhere to state-specific data protection laws. The American Veterinary Medical Association (AVMA) notes that 35 states have statutes addressing confidentiality for pets and livestock, including California, Georgia, Florida, and Kentucky (USDA, 2025) (HIPAA, 2024).

Furthermore, the Animal Welfare Act (AWA) in the U.S. sets standards for the humane treatment of animals, which could impact the design and functionality of stress detection devices to ensure they do not cause distress or harm. In the European Union, veterinary medical devices are subject to regulatory oversight, though the framework is less defined compared to human medical devices. Manufacturers must navigate these regulations to ensure compliance and market acceptance. Economic factors, such as variable component costs and the need for substantial investment in research and development, also play a crucial role in the feasibility and scalability of the product. The specialized nature of biometric sensors and thermal imaging components means that suppliers hold considerable bargaining power, potentially leading to increased production costs and supply chain vulnerabilities. Environmental considerations, including sustainable manufacturing practices and electronic waste management, are increasingly important in today’s eco-conscious market. Consumers are becoming more aware of the environmental impact of electronic devices, prompting companies to adopt greener practices to appeal to this demographic. Social factors, such as evolving consumer attitudes toward animal health and the integration of technology in pet care, further influence the product’s acceptance and success. The trend of humanizing pets has led to increased spending on pet health and wellness, creating a favourable market for innovative products (Eurpean Commission, 2024) (EPA, 2025).

## 4.2 SWOT ANALYSIS

STRENGTH

The primary strength of the proposed product lies in its innovative integration of thermal and biometric sensing tailored specifically for Sphynx cats. This focus addresses a niche market with unique health monitoring needs due to their distinct physiology. By offering a non-invasive, real-time stress detection solution, the product enhances pet care and strengthens the bond between pets and their owners. Additionally, the emphasis on early stress detection can lead to timely interventions, potentially reducing veterinary costs and improving the overall well-being of the cats (Agency, 2023).

WEAKNESS

However, the technological complexity of ensuring reliable and consistent data collection in home environments presents a significant challenge. Uncontrolled external factors, such as varying ambient temperatures and the cat’s activity levels, could compromise sensor accuracy. Moreover, the high development and production costs associated with advanced biometric sensors may result in a higher retail price, potentially limiting accessibility for some pet owners. There is also the risk of resistance from traditional veterinarians who may be sceptical of integrating AI-based tools into established diagnostic practices (EBF, 2024).

OPPORTUNITY

The market opportunity is buoyed by increasing consumer interest in personalized and non-invasive pet healthcare solutions. As pet owners become more invested in the health and well-being of their animals, there is a growing demand for innovative products that offer convenience and peace of mind. Collaborations with veterinary professionals and pet care brands could further validate the product’s efficacy and expand its reach. Additionally, the rise of smart home ecosystems presents an opportunity to integrate the stress detection system with other connected devices, enhancing user experience and engagement. The pet wearable market is projected to grow significantly, indicating a favourable environment for such innovations (Chén, 2021).

THREAT

Conversely, potential threats arise from competition with established veterinary diagnostic tools and other emerging technologies that offer similar benefits at a lower cost. The rapid pace of technological advancement means that new entrants could quickly render the product obsolete if continuous innovation is not maintained. Economic downturns or shifts in consumer spending habits could also impact the willingness of pet owners to invest in such specialized devices. Furthermore, any incidents of data breaches or malfunctions could damage the brand’s reputation and erode consumer trust. The pet tech market is experiencing robust growth, attracting numerous players and intensifying competition (Appleby, 2023).

|  |  |
| --- | --- |
| Strengths:  Innovative integration of thermal and biometric sensors for application to Sphynx cats. Gives non-invasive, real-time stress tracking to improve pet care and early health treatment. | Weaknesses:  Challenge to guarantee accuracy of sensors in home environment with outside variables like temperature and cat movement. Production cost being high may lead to high prices. Reluctant traditional vets to AI-based diagnosis. |
| Opportunities:  Growing demand for personalized pet health technology. Potential for collaboration with pet care businesses and vets. Can be integrated into smart home products. Increasing market size for pet wearables supports product development. | Threats:  Competition from established and lower-cost alternatives. Potential for rapid obsolescence without R&D. Recessions in the economy could affect consumers’ behaviour. Data security issues could harm reputation. |

Table 1 SWOT Analysis

## 4.3 INDUSTRY ANALYSIS

### 4.3.1 ATTRACTION AND CUSTOMER DEMAND

The pet technology industry has witnessed substantial growth, driven by pet owners’ increasing willingness to invest in their pets’ health and well-being. This trend is particularly pronounced among younger generations, such as Millennials and Generation Z, who view their pets as integral family members and are more inclined to spend on advanced care solutions. In 2024, 18.8 million Gen Z households owned a pet, a 43.5% increase from 2023. The demand for non-invasive, real-time health monitoring devices reflects a broader societal shift toward proactive and preventive healthcare, extending to the realm of pet care. As a result, products that offer convenience, accuracy, and integration with digital lifestyles are highly attractive to this customer segment (GMI, 2024).

### 4.3.2 PORTER’S FIVE FORCES ANALYSIS

Firstly, for the threat of new entrants, the pet technology market is experiencing rapid growth, attracting numerous start-ups and established companies. While the initial investment in research and development for advanced biometric devices is substantial, the potential for high returns makes the market appealing to new entrants. However, building brand recognition and trust among pet owners and veterinary professionals poses a significant barrier to entry. Secondly, the specialized nature of biometric sensors and thermal imaging components means that suppliers hold considerable bargaining power. Dependence on a limited number of suppliers for high-quality components could lead to increased production costs and potential supply chain vulnerabilities. The biometric sensors market was valued at over USD 1.8 billion in 2023 and is estimated to register a CAGR of over 12.5% between 2024 and 2032, indicating the critical role of suppliers in this sector (GMI, 2024) (Shahbandeh, 2024).

Thirdly, pet owners have access to a wide range of pet care products and are becoming increasingly discerning. The availability of alternative health monitoring solutions empowers buyers to demand high-quality, reliable, and affordable products. Building strong customer relationships and demonstrating clear value propositions are essential to mitigate this power. Threat of Substitutes: Traditional methods of stress detection, such as behavioural observation and periodic veterinary check-ups, serve as substitutes for the proposed product. Additionally, other technological solutions offering similar functionalities could emerge, posing a threat. Differentiating the product through unique features and proven accuracy is crucial to counter this threat. Lastly, the pet technology sector is characterized by intense competition, with numerous players striving for market share. Continuous innovation, strategic partnerships, and effective marketing strategies are vital to maintain a competitive edge in this dynamic landscape. The pet tech market’s expected growth from USD 12.7 billion in 2024 to USD 41.3 billion in 2032, at a CAGR of 15.9%, highlights the competitive and rapidly evolving nature of the industry (BI, 2025) (Verma, 2024).

## 4.4 TARGET MARKET ANALYSIS

Demographics

The primary target market comprises affluent pet owners, particularly those within the Millennial and Generation Z cohorts, who are more likely to invest in advanced health monitoring solutions for their pets. As of 2024, Millennials represented the largest share of pet owners in the United States at 32%, followed closely by Baby Boomers at 27%, and Generation X at 24%. Generation Z, while currently representing a smaller segment, is rapidly growing, with 20% of U.S. households owning a pet in 2024, marking a 43.5% increase from the previous year. These individuals often have higher disposable incomes and prioritize their pets’ well-being, viewing them as family members. Additionally, veterinary professionals and specialty pet care providers represent a secondary market, as they may incorporate such technologies into their practice to enhance diagnostic capabilities (Shahbandeh, 2025) (APPA, 2025).​

Psychographics

Target consumers are characterized by a proactive approach to health and wellness, extending this mindset to their pets. They are tech-savvy, comfortable integrating new technologies into their daily lives, and value products that offer convenience and peace of mind. This segment often seeks out the latest innovations and is willing to invest in premium products that align with their lifestyle and values. Notably, younger generations, particularly Millennials and Generation Z, are more inclined to humanize their pets, considering them integral family members and seeking products that enhance their pets’ quality of life. They are also likely to be influenced by social proof, such as reviews and endorsements from trusted sources (Wall, 2025).​

Behavioural

These consumers exhibit a high level of engagement with digital platforms, frequently researching pet care information online and participating in pet-related communities. They are inclined to purchase products that offer tangible benefits and have a track record of reliability. Loyalty can be fostered through exceptional customer service, ongoing product support, and engagement initiatives that resonate with their values and interests. The increasing trend of purchasing pet products online, with over 50% of Millennial and Generation Z pet owners doing so, underscores the importance of a strong digital presence and e-commerce capabilities (Shahbandeh, 2024).

Geographic Location

Urban areas in developed regions are the initial focus for market entry, given the higher concentration of tech-savvy pet owners with disposable income. These regions often have a robust infrastructure to support the distribution and servicing of advanced technological products. Additionally, urban pet owners may face unique challenges, such as limited space and higher stress environments for pets, making stress detection and management solutions particularly relevant. The United States, with a significant and growing pet ownership base, particularly among younger generations, represents a key market. In 2024, Generation Z comprised 20% (18.8 million) of U.S. households that owned a pet, a 43.5% increase from 2023, indicating a rapidly expanding market segment (APPA, 2025).

# 5.0 PROPOSED SOLUTION

## 5.1 QUESTIONNAIRE

The questionnaire is divided into three sections. This help to collect relevant data on the SphynxSense application and product.

The first section, demographics questions. This help to gather background information about the respondents or users that include questions about their age, pet ownership status and whether they own a Sphynx cat. It also evaluates their level of familiarity with smart pet devices and pet health monitoring apps. The target audience and their level of familiarity with pet-related technology are better understood in this section. The respondents’ knowledge and opinions of the SphynxSense application are the main topics of the second section B, general questions. It enquires about their interest in using such a tool, whether they have heard of the app previously, and whether they believe that Sphynx cats need health monitoring. This section also looks at whether respondents think real-time health tracking is useful and if they would buy a product that works with the app. These observations aid in determining the level of market interest and the uniqueness of the SphynxSense solution.

The respondents’ experiences using the SphynxSense application are evaluated in the last section, experience after using the product or application. It looks at how user-friendly the app is, how well it offers health insights, and whether it gave users more confidence in maintaining on their pet’s health. It also asks users if they plan to keep using the app and if they would suggest it to other Sphynx cat owners, this help to evaluate user satisfaction and identify potential areas for development, this section is crucial.

SECTION A: DEMOGRAPHIC INFORMATION

1. **Are you aged 18 years or older?**

(Yes/No)

1. **Are you a pet owner?**

(Yes/No)

1. **Do you currently own a Sphynx cat?**

(Yes/No)

1. **Are you familiar with pet health monitoring applications?**

(Yes/No)

1. **Have you ever used a pet related to smart device before?**

(Yes/No)

SECTION B: GENERAL QUESTIONS

1. **Have you heard of the SphynxSense application before this survey?**

(Yes/No)

1. **Do you think pet owners need an application to monitor their Sphynx cat’s health?**

(Yes/No)

1. **Would you be interested in an app that tracks your Sphynx cat’s temperature and stress levels?**

(Yes/No)

1. **Do you think real time health monitoring is important for Syphnx cats?**

(Yes/No)

1. **Would you consider purchasing a product that integrates with the SphynxSense app?**

(Yes/No)

SECTION C: EXPERIENCE AFTER USING THE PRODUCT AND APPLICATION

1. **Did you find the SphynxSense app easy to use?**

(Yes/No)

1. **Did the app provide useful insights about your cat’s health, especially Sphynx types?**

(Yes/No)

1. **Do you feel more confident in monitoring your Sphynx cat’s well-being after using the app?**

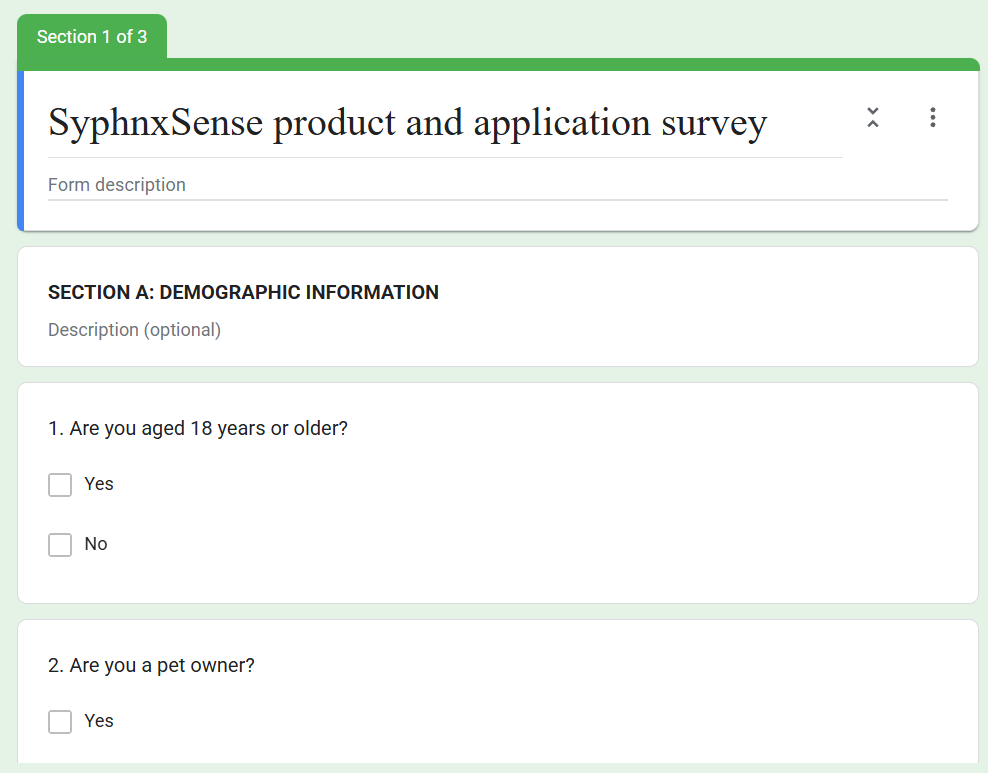
(Yes/No)

1. **Would you recommend the SphynSense app to other Sphynx cat owners?**

(Yes/No)

1. **Would you continue using the SphynxSense app in the future?**

(Yes/No)



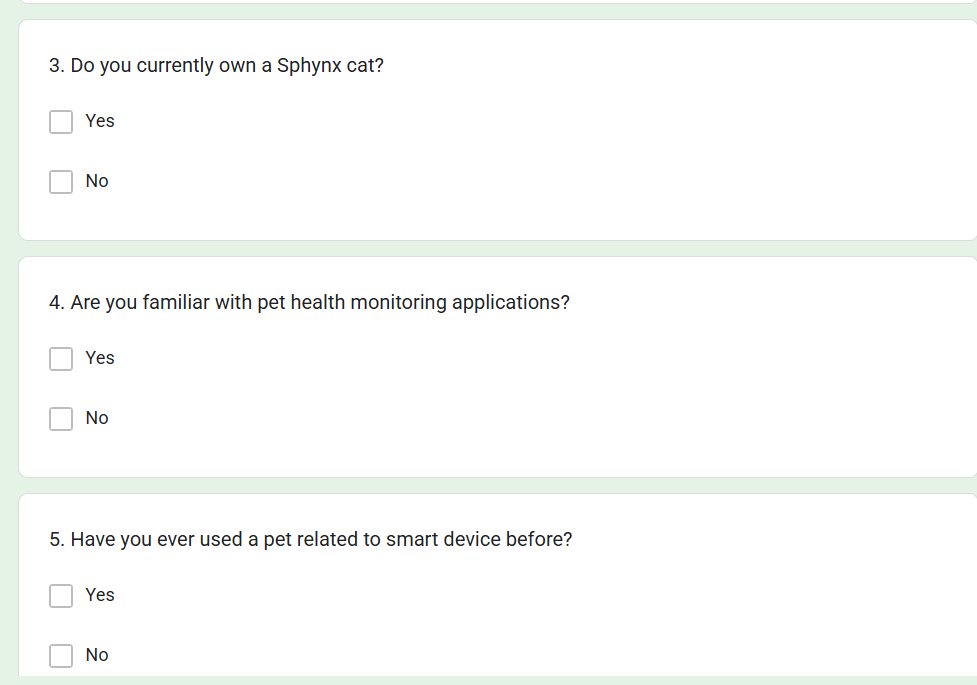
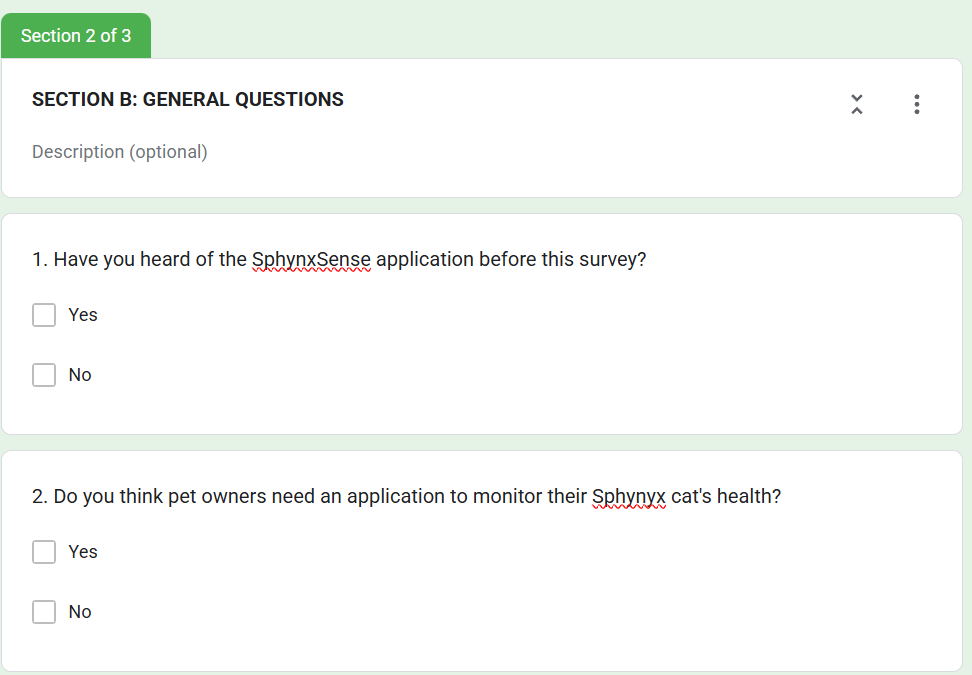


Figure 2: Section A: Demographic Information



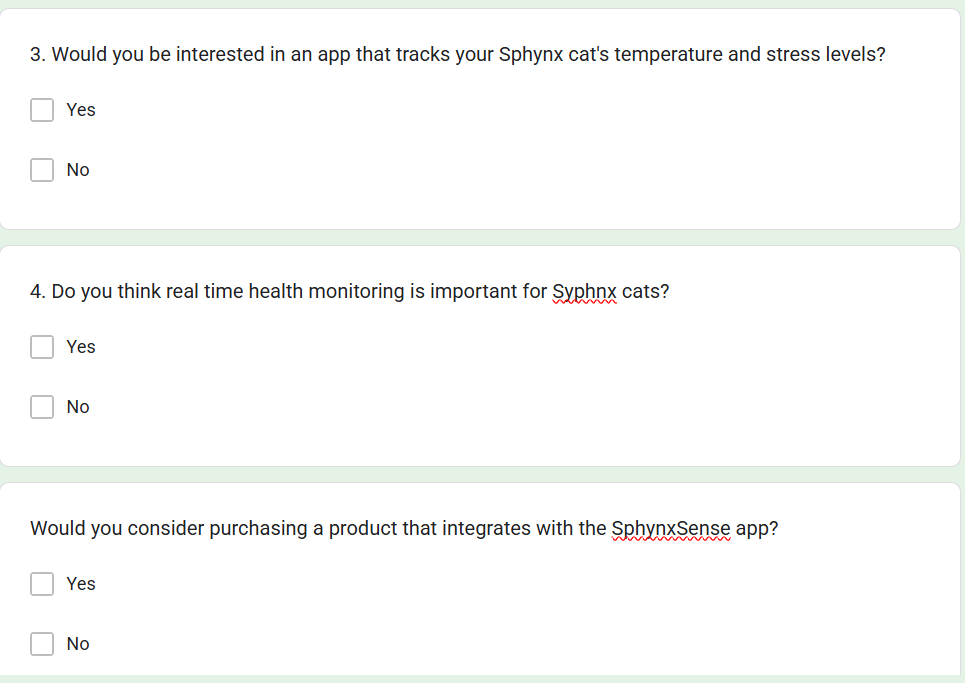
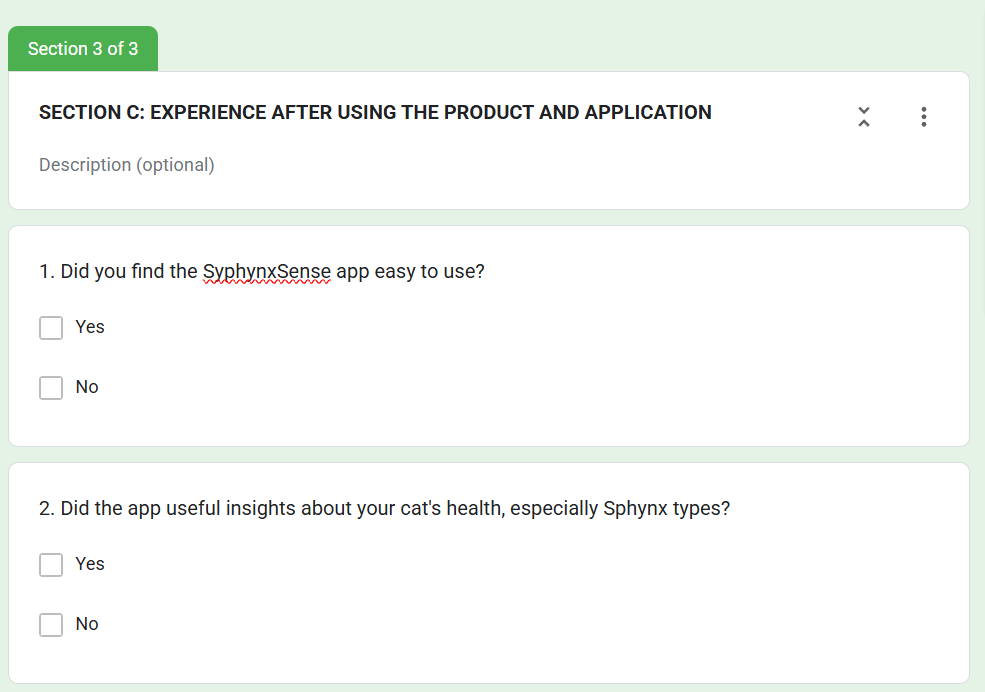


Figure 3: Section B: General questions of our product



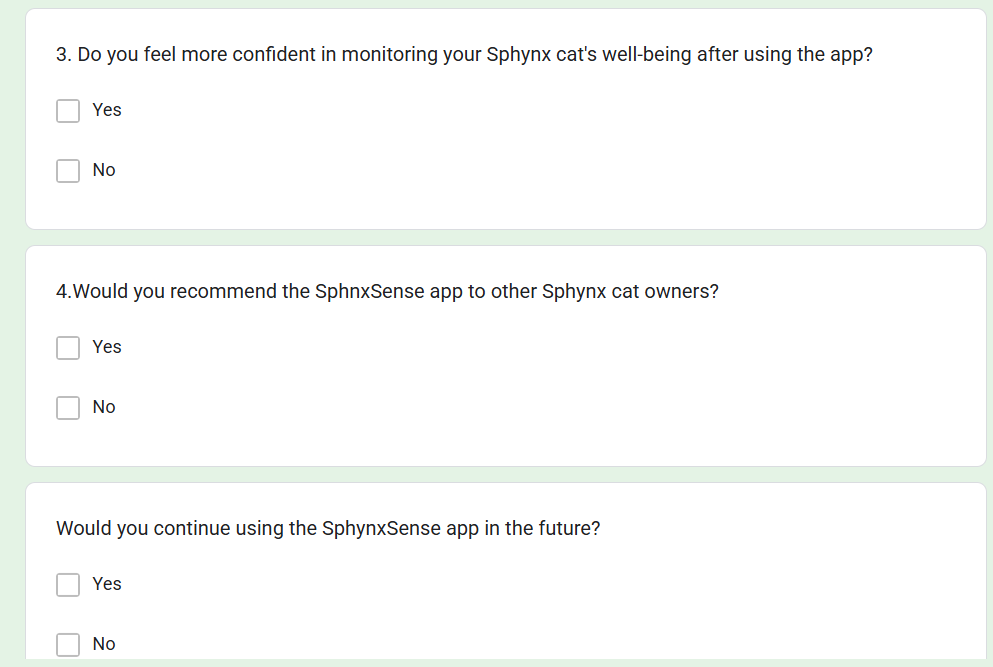


Figure 4: Section C: Experience after using the product and application

# 6.0 PLAN OF WORK

## 6.1 SCOPE OF RESEARCH

The SphynxSense System is an innovative AI-powered monitoring solution designed to detect stress in Sphynx cats by analysing temperature fluctuations. This advanced system seamlessly integrates hardware and software components to provide real-time monitoring to ensure accurate stress detection and timely intervention by pet owners to enhance their cat’s overall well-being.

### 6.1.1 THE SPHYNX SYSTEM: HARDWARE AND SOFTWARE INTEGRATION

The SphynxSense System is designed to provide an innovative and reliable solution for monitoring the stress levels of Sphynx cats through temperature fluctuations. This system consists of two core components which are hardware and software components. Firstly, the hardware component consists of a lightweight smart collar embedded with temperature sensors and AI-driven analytics to detect stress related changes in a Sphynx cat’s body temperature (Alpine, 2024). On the other hand, the software component is a mobile application called SphynxSense Application, which connects to the collar to process and display real-time data. The combination of these two components enables precise and continuous monitoring of the cat’s condition, offering valuable insights to pet owners (Seitz, 2025).

### 6.1.2 JUSTIFICATION AND ADVANTAGES OF THE SOLUTION

The SphynxSense System offers a comprehensive approach to monitoring stress in Sphynx cats, addressing several limitations inherent in traditional methods. By leveraging advanced technology, this solution provides objective, timely, and breed-specific insights, thereby enhancing pet welfare and owner confidence.

#### ****6.1.2.1 OBJECTIVITY OVER SUBJECTIVE BEHAVIOURAL ANALYSIS****

Traditionally, cat owners have relied on behavioural cues to assess their pets’ well-being. However, such observations can be subjective and potentially misleading, as individual interpretations may vary. For instance, a cat’s reduced appetite might be perceived as stress-related by one owner, while another might attribute it to a temporary dietary preference. This subjectivity can lead to inconsistent assessments and delayed interventions. In contrast, the SphynxSense System employs AI-based temperature monitoring, providing objective and quantifiable data on stress levels. By analysing precise temperature fluctuations, the system minimizes the ambiguity associated with behavioural observations, ensuring more accurate assessments. This objectivity is crucial for timely and appropriate responses to a cat’s needs (Suborna & Vishakha, 2025).

#### 6.1.2.2 EARLY DETECTION AND TIMELY INTERVENTION

Stress in cats, if left unaddressed, can lead to various health complications, including weakened immune responses and behavioural issues. Early detection is therefore essential. The real-time temperature tracking capabilities of the SphynxSense System enable prompt identification of stress indicators. For example, if the system detects a sudden increase in a cat’s body temperature, it can immediately alert the owner through the mobile application. This timely notification allows the owner to investigate potential stressors, such as environmental changes or health issues, and take proactive measures to alleviate the cat’s discomfort. Consequently, early intervention facilitated by the system can prevent the escalation of stress-related problems, promoting better health outcomes for the cat (Talaat, 2023).

#### 6.1.2.3 BREED- SPECIFIC OPTIMIZATION

Generic pet monitoring devices often fail to account for the unique physiological traits of specific breeds. Sphynx cats, characterized by their lack of fur, have distinct thermoregulation needs and are more sensitive to temperature variations. The SphynxSense System is exclusively designed with these considerations in mind. By tailoring its sensors and algorithms to the specific characteristics of Sphynx cats, the system ensures more accurate monitoring and stress detection. This breed-specific optimization enhances the reliability of the data collected and the subsequent recommendations provided to the owner, leading to more effective stress management strategies (Dr. Pete Wedderburn, 2023).

#### 6.1.2.4 POTENTIAL FOR SCALABILITY

While the SphynxSense System is initially focused on Sphynx cats, its underlying technology possesses significant potential for expansion. The modular design of the system allows for adaptations to accommodate other cat breeds and even small dog breeds in the future. This scalability is facilitated by the system’s flexible software architecture and adjustable hardware components, which can be modified to suit the physiological traits of different animals. By broadening its applicability, the system can cater to a wider market, offering reliable stress monitoring solutions to a diverse range of pet owners (Celeritas, 2025) (PetGenius, 2024).

#### 6.1.2.5 IMPROVED PET WELFARE AND OWNER CONFIDENCE

The integration of AI-powered insights into the SphynxSense System provides pet owners with evidence based guidance on their cat’s well-being. This data-driven approach enhances owners’ confidence in understanding and managing their pets’ health. FOR instance, if the system indicates elevated stress levels, the owner can refer to the app’s recommendations to implement appropriate interventions, such as environmental enrichment or consultation with a veterinarian. By facilitating informed decision-making, the system contributes to improved pet welfare, ensuring that cats receive timely and appropriate care tailored to their specific needs (PetSignals, 2025) (Celeritas, 2025).​ In summary, the SphynxSense System addresses the limitations of traditional stress detection methods by providing objective data, enabling early interventions, offering breed-specific insights, and possessing scalability for broader applications. These advantages collectively enhance pet welfare and equip owners with the tools necessary for informed and effective pet care.

### 6.1.3 AI MODEL AND DATA PROCESSING PIPELINE

The SphynxSense System’s stress detection mechanism is meticulously designed to ensure high accuracy and reliability through a structured AI-driven pipeline. This comprehensive approach encompasses several critical stages, each contributing to the system’s overall effectiveness.​

#### 6.1.3.1 DATA COLLECTION AND PREPROCESSING

Initially, the smart collar continuously records temperature readings and transmits them to the mobile application. Alongside temperature monitoring, the motion sensor tracks the cat’s movements to eliminate false positives caused by physical activity. This dual-sensor approach ensures that the data collected is both comprehensive and accurate. In wearable health monitoring systems, preprocessing steps such as data synchronization and noise reduction are essential to prepare the data for accurate analysis. For instance, the ‘PetPace’ collar employs similar methodologies to monitor vital signs in pets, ensuring data integrity before analysis.

#### 6.1.3.2 FEATURE EXTRACTION

Subsequently, the system analyses the collected data by identifying patterns and temperature fluctuations over time. Establishing a baseline temperature for each individual cat allows for personalized monitoring. Detecting sudden or gradual increases that might indicate stress is crucial for timely intervention. In real-time data analysis for health monitoring systems, feature extraction is vital for transforming raw data into meaningful indicators of health status. For example, AI technologies have been developed to detect emotions in animals by analysing vocalizations, which is a form of feature extraction. ​

#### 6.1.3.3 MACHINE LEARNING MODEL SELECTION

To enhance the accuracy of stress detection, the system evaluates different AI models. Neural networks, or deep learning models, are capable of identifying complex relationships between temperature fluctuations and stress levels. Decision trees provide easy-to-interpret classifications based on specific temperature thresholds. Additionally, k-nearest neighbours (k-NN) algorithms recognize stress patterns by comparing new data to historical cases. The selection of an appropriate model depends on factors such as the complexity of the data and the desired balance between accuracy and interpretability. For instance, in human stress detection systems, machine learning models analyse physiological data to predict stress levels accurately (Karen, 2019). ​

#### 6.1.3.4 PREDICTION AND CLASSIFICATION

Once processed, the AI model classifies stress levels into distinct categories. A ‘Calm’ state corresponds to normal temperature fluctuations, indicating no stress. ‘Moderate Stress’ reflects noticeable changes, requiring mild intervention. ‘High Stress’ signifies significant deviations, triggering immediate alerts and recommendations. If stress is detected, the system sends real-time notifications, guiding owners on appropriate responses. This proactive approach ensures that potential health issues are addressed promptly, thereby enhancing the well-being of the pet. In wearable health monitoring systems, real-time data analysis enables timely interventions, which are crucial for effective health management (Reed, 2024). ​

Integration with Cloud-Based Data Analysis

Moreover, integrating cloud-based data analysis allows for the storage and processing of large datasets, facilitating more sophisticated AI-driven insights. This feature enables long-term health tracking and personalized care recommendations, enhancing the system’s value to pet owners. For example, advanced pet health monitoring systems utilize cloud technology to analyse data over time, providing deeper insights into an animal’s health trends (PetSignals, 2025). ​

Ethical Considerations and Future Prospects

Furthermore, the ethical implications of using AI in monitoring animal emotions and health are significant. While AI offers precise tools for assessing animal well-being, it is crucial to ensure that these technologies are used to enhance animal welfare genuinely and not merely for human convenience. For instance, AI systems have been developed to detect emotions in animals, raising discussions about their ethical use in improving animal welfare (Bell, 2025). ​

In conclusion, the SphynxSense System’s AI model and data processing pipeline are meticulously designed to provide accurate and reliable stress detection in Sphynx cats. Through continuous data collection, sophisticated feature extraction, careful model selection, and precise classification, the system offers a comprehensive solution to monitor and enhance feline well-being. The integration of cloud-based data analysis and consideration of ethical aspects further solidify its role as an innovative tool in pet health monitoring.

### 6.1.4 FEASIBILITY AND SCALABILITY

#### 6.1.4.1 TECHNICAL FEASIBILITY

The SphynxSense System is built to be both technically reliable and easy to implement, making it a strong candidate for success in the smart pet care industry. By combining artificial intelligence (AI) with biometric sensors, this system offers an innovative way to monitor stress levels in Sphynx cats, a breed particularly sensitive to temperature changes and anxiety (Calderone, 2024).

The system is equipped with high-precision biometric sensors that track subtle physiological changes, such as fluctuations in body temperature and stress-related indicators. This approach mirrors advancements seen in human health wearables like the Apple Watch and Fitbit, which use real-time sensor data to detect early signs of stress. Research from the National Institutes of Health (NIH, 2024) confirms that biometric sensors have significantly improved stress monitoring in humans, demonstrating the reliability of this technology for pets (NIH, 2023). Additionally, the device is designed to be energy-efficient, using low-power consumption components to extend battery life. Advances in battery optimization, as highlighted by the Journal of Sensor Technology (2024), ensure that modern wearable devices can operate continuously without frequent recharging. This makes the SphynxSense collar not only convenient but also practical for long-term use (Yu, 2024).

#### 6.1.4.2 CONNECTIVITY AND DATA TRANSMISSION

One of the key strengths of the SphynxSense System is its seamless connectivity. The collar comes with Bluetooth and Wi-Fi capabilities, allowing real-time data transmission to the SphynxSense mobile application. This ensures pet owners receive instant updates on their cat’s health, helping them detect potential stress issues before they escalate. A study from MIT’s Internet of Things (IoT) Lab (2024) highlights how robust connectivity in wearables enhances real-time analytics, improving both user experience and the accuracy of collected data. This connectivity ensures that SphynxSense remains reliable and responsive, even in different environments (MIT, 2020).

#### 6.1.4.3 COMMERCIAL VIABILITY

The demand for AI-driven pet care solutions has been growing rapidly, making the SphynxSense System a commercially viable product. According to Grand View Research (2024), the global pet care market is expected to surpass $202.6 billion by 2025, with smart health monitoring devices playing a significant role in this growth (GVR, 2024). The affordability of AI-powered wearables has also improved due to advancements in sensor miniaturization and AI chip manufacturing. Research by McKinsey & Company (2024) shows that economies of scale have helped drive down production costs, making smart collars like SphynxSense more accessible to a wider audience. This allows the product to be competitively priced while maintaining its high-tech capabilities (McKinseyDigital, 2023).

#### 6.1.4.4 SCALABILITY AND FUTURE ENHANCEMENTS

The SphynxSense System is designed to expand beyond its initial focus on Sphynx cats. The underlying technology can be adapted for other cat breeds and small dog breeds, broadening the potential customer base. Brands like Whistle and ‘FitBark’, originally designed for dogs, later introduced feline monitoring due to increasing demand (Whistle, 2025). Future versions of SphynxSense could integrate additional biometric sensors to track heart rate and respiratory rate, offering an even more detailed assessment of pet health. Research from the IEEE Sensors Journal (2024) supports the effectiveness of multi-sensor monitoring in detecting early signs of cardiovascular distress, suggesting that such enhancements would further benefit pet owners (Cinquino, 2025).

Another exciting avenue for scalability is cloud-based AI analytics. By storing historical stress patterns in a secure cloud database, AI-driven insights can provide personalized health recommendations for each pet. According to Google’s AI for Social Good initiative (2024), cloud-based AI systems have been highly effective in early disease detection by identifying behavioural anomalies through historical data analysis (Tatananni, 2024).

In summary, the SphynxSense System stands out as a technically advanced, commercially viable, and highly scalable solution in the pet healthcare industry. Its cutting-edge features ensure accurate stress detection, while the growing interest in smart pet technology supports its market adoption. With continuous advancements in AI, biometric sensors, and cloud computing, SphynxSense has the potential to become a comprehensive pet health monitoring platform. As pet owners increasingly seek innovative solutions for their pets’ well-being, SphynxSense is well-positioned to lead the way in AI-driven pet care.

## 6.2 TIMELINE

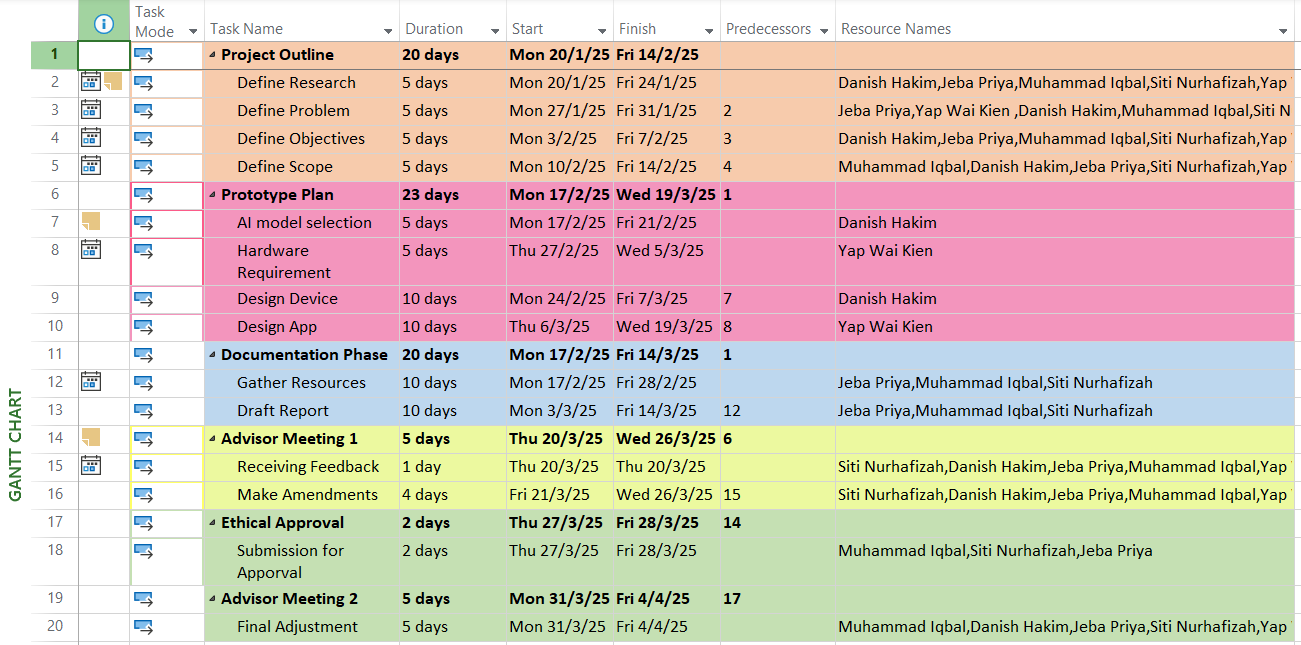


Figure 5 Gantt Chart

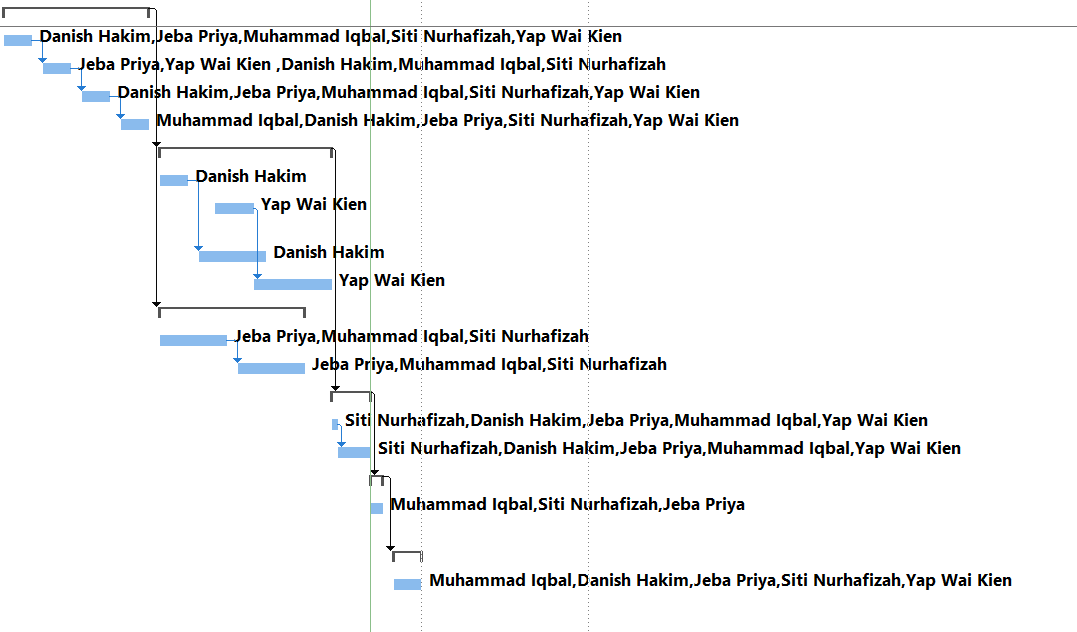


Figure 6 The project timeline including the roles, responsibilities, tools and technologies

The project timeline, which operates from 20 January to 4 April 2025 is to ensures an organized and systematic approach to reaching important standards. Project Outline, Prototype Plan, Documentation Phase, Advisor Meetings, Ethical Approval, and Final Adjustments are the six main stages of the workflow. Depending on their roles and areas of expertise, particular team members are given assigned tasks for each phase. Yap Wai Kien (UX Engineer) and Danish Hakim (Prototype Designer) oversee the technical elements, which include hardware configuration and AI model selection. While Jeba Priya (Project Manager) manages the business feasibility and approval procedures, Siti Nurhafizah (Business Development Manager) and Muhammad Iqbal (Editor/Researcher) concentrate on conducting research, writing, and guaranteeing high quality documentation. To ensure smooth transitions from one milestone to the next, the team uses ordered workflow with dependencies between tasks. The Gantt chart is used to track progress using collaboration tools like Microsoft Project, and a variety of AI and software development tools such as Figma to help with implementation and prototyping. Before the project is finished, advisor meetings act as checkpoints for comments, feedback and changes to guaranteeing ongoing progress successfully following the criteria needed. Productivity, accountability, and alignment with the project’s goals are all improved by the well-organized plan.

## 6.3 RESOURCES

### 6.3.1 HARDWARE REQUIREMENT

Smart Collar

|  |  |
| --- | --- |
| Hardware | Specifications |
| Core Electronics | * Primary Microcontroller Unit with Integrated Bluetooth/Wi-Fi * Secondary Microcontroller for offload sensor management * High-accuracy thermistor for temperature sensing * Location Tracking Module |
| Power Supply | * Rechargeable Battery that lasts for 5-7 days * Type C Charging Port |
| Enclosure | * Durable, waterproof, and hypoallergenic |
| Collar Strap | * Biothane with reflective strip |
| Collar Type | * Breakaway Buckle for pet safety |
| Tag | * D-Ring for sturdiness |
| Tactile Push Button | * On/Off button with LED indicator |

Table 2 Hardware Requirement for device

SphynxSense Application

|  |  |
| --- | --- |
| Hardware | Specifications |
| Supported Operating Systems | * Android 9.0 (Pie) and above * Ios 13.0 and above |
| Hardware Requirements (Smartphone/Tablet) | * Minimum 2GB RAM and Quad-core processor * Bluetooth 5.0 support for syncing with wearable * Minimum 1280x720 screen resolution |
| Storage | * App size: Approx. 50- 100 MB * Additional 100 MB for cached data and report |
| Permissions | * Bluetooth access (for data sync) * Internet access (for cloud syncing and notification) * Notification access (for real-time alerts) * Local storage (for cached data) |

Table 3 Hardware Requirement for Mobile Applications

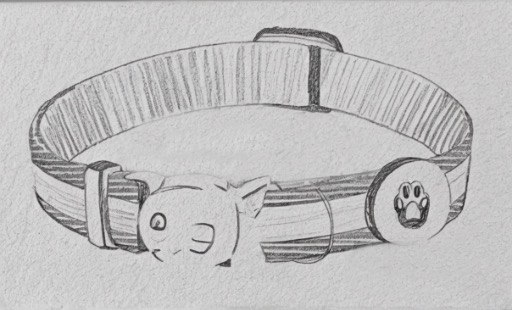


Figure 5 Smart Collar Sketch

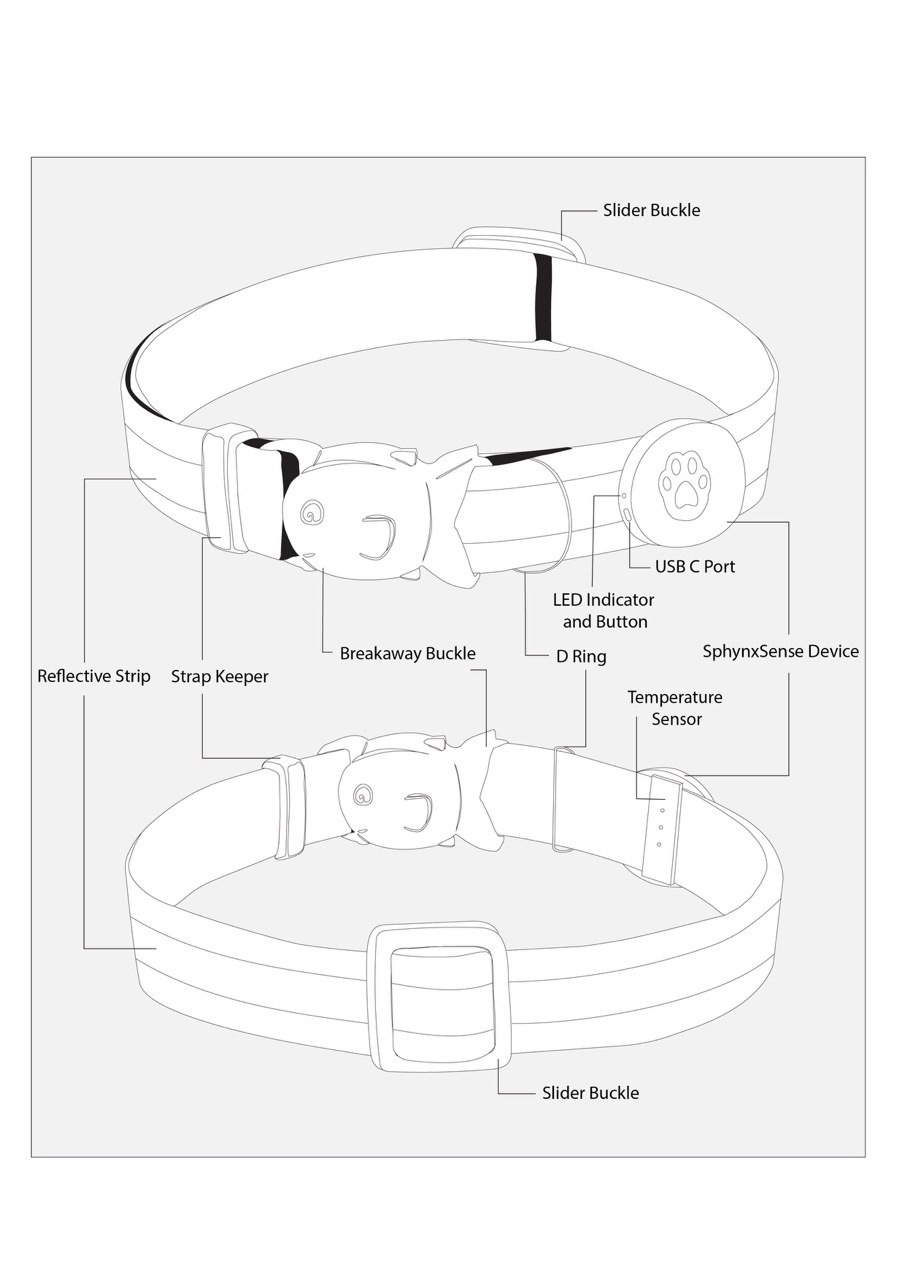
Figure 6 Finalise design of Smart Collar

Figure 7 Smart Collar Manual

### 6.3.2 SOFTWARE REQUIREMENT

|  |  |
| --- | --- |
| Software | Specifications |
| SyphyxSense Mobile App  (customer point of view) | * Must be downloaded from Google Play or Apple App Store * Regular updates should be installed for performance and security improvement |
| User profile setup | * Users create an account and password and email * Each cat must have a profile name, age, breed, medical notes * Wearable must be paired with the app during initial setup |
| Basic User Tasks | * Check app daily for pet stress updates and health reports * Ensure Bluetooth and app notifications are enabled |
| AI Model Hosing | * Hosted model trained on temperature patterns |
| API Services | * RESTful APIs for app-device-server communication |

Table 4 Software Requirement for mobile application

# 7.0 LEGAL, ETHICAL AND PROFESSIONAL ISSUES

## 7.1 ETHICAL ISSUES IN AI AND PET WELFARE

**School of Computer Science & Maths**

**5610TECYPC Research Analysis for E-Business Technology – Ethical Approval**

This form is to be used to provide information on any proposed involvement of participants in the proposal and to ensure safeguards are in place to deal with ethical issues relating from their involvement.

There are two distinct parts to the approval:

* Approval to conduct work in the preparation of the proposal
* Approval to conduct the work detailed in the proposal

The form must be completed *before* you have any involvement from participants. You are required to submit the form to Google Classroom before presentation day.

1. **Project details**

|  |  |
| --- | --- |
| Group Name | CatCode |
| Group Members | 1. Danish Hakim bin Mohd Ezham  2. Yap Wai Kien  3. Jeba Priya a/p Gnanapregasam  4. Siti Nurhafizah binti Ab Hamid  5. Muhammad Iqbal bin Aswadi Fitri |
| Programme | BSc (Hons) Multimedia Computing |
| Workshop Leader | Ms Nurul Nasuha Zolkefly |
| Brief description of the proposal (no more than one paragraph) | The SphynxSense System is a smart collar for Sphynx cats. It uses AI to track body temperature for detecting early signs of stress. This system offers continuous monitoring, which should improve cat health and owner awareness. |

1. **Ethical Approval for the Preparation the Proposal**

Tick one of the following

The preparation of the proposal does not require ethical approval

or

The preparation of the proposal requires ethical approval

If you have checked the second box, complete the remainder of Section 2 before moving on to Section 3. *Note that* *if your plans change you may need to seek re-approval.*

* 1. **Description of the activity involving participants**

Participants, specifically Sphynx cats, will wear a custom-designed smart collar for continuous monitoring of body temperature. This is necessary to gather real-time data for AI-driven stress detection which enables accurate and objective assessment of feline well-being.

* 1. **Description of risks involved in the participants involvement**

Risks include potential discomfort or irritation from collar wear, and the possibility of data inaccuracies due to sensor malfunction or environmental interference. There is also the risk of data privacy concerns regarding the storage and use of sensitive animal data.

* 1. **Description of the measures in place to mitigate ethical concerns**

A pilot study to ensure collar comfort and fit, gradual adoption of cats to the device, regular sensor calibration, secure data storage with restricted access, and adherence to all relevant animal welfare and data privacy regulations. Veterinary oversight will be maintained throughout the study. Real-time alerts will be available to owners so that any signs of discomfort can be quickly addressed.

1. **Ethical Approval to conduct the work in the Proposal**

In order for ethical approval to be granted you have to supply appropriate detail of any planned user activity that is part of the proposal. Please answer the questions in this section as fully as possible. If you do not yet know the details of the study then give an outline of the ***likely*** activity. It is expected that all group proposals will involve either participants or the use of participant data. If in doubt you should discuss with the workshop leader.

* 1. Outline any proposed activities involving (interviews, observation, focus groups, questionnaire etc. Include how participants are selected, included or excluded?)

The primary activity involves the continuous, non-invasive monitoring of Sphynx cats using a custom-designed smart collar. Participants will be selected based on breed confirmation, age, and owner willingness to participate. Exclusion criteria include pre-existing medical conditions that might interfere with data collection, and cats with known collar allergies or sensitivities. A pilot study involving a small number of cats will be conducted to refine the collar design and data collection protocols. Observations will be done on the cats’ behaviour during the testing period. Owners will also be asked to complete a short questionnaire regarding their cat’s behaviour and any observed changes during the monitoring period.

* 1. Where will the proposed activity/activities take place?

The collar wearing will take place in the cats’ home environments which ensures minimal disruption to their routines. The questionnaire will be completed online. The pilot study may occur in a controlled veterinary setting.

* 1. Who do you expect your participants to be? What will the age ranges of the participants be? What are your arrangements for dealing with vulnerable people, e.g. seeking consent of their parents/carers?

Participants will be adult Sphynx cats with an age range of 1-10 years. As the participants are animals, informed consent will be obtained from their owners. Owners will be fully informed about the study’s purpose, procedures, and potential risks. Vulnerable animals like those with pre-existing health conditions will be excluded.

* 1. What will the participants be asked to do?

The cats will be asked to wear a lightweight, custom-fitted smart collar for a specified period. The collar will continuously collect body temperature data. Owners will be asked to maintain their cats’ regular routines and complete a short questionnaire about their cat’s behaviour.

* 1. What potential risks do the activities pose to you or your participant/s and how will they be overcome?
* **Discomfort or irritation from collar wear**

Use hypoallergenic materials, ensuring proper fit, and conducting a pilot study.

* **Stress induced by monitoring**

Gradual acclimatization, positive reinforcement, and minimal intervention.

* **Data inaccuracies**

Regular sensor calibration and data validation

* **Data privacy breach**

Secure data storage, restricted access, and anonymisation

* 1. How do you intend to manage the privacy and confidentiality of users’ data?

All data will be anonymised, and identifying information will be removed. Data will be stored on secure, password-protected servers with restricted access. Data transfer will be encrypted. Only authorized personnel will have access to the data.

* 1. How will you maintain the confidentiality of data resulting from your research activity?

Data will be stored in a secure, encrypted database. Access will be limited to authorised researchers. Data will be anonymised in any publications or presentations. Data will be retained only for the duration of the study and a defined period afterwards, as per ethical guidelines.

* 1. How do you intend to secure the informed consent of your participant/s?

Informed consent will be obtained from the cats’ owners. Owners will receive a detailed information sheet outlining the study’s purpose, procedures, risks, and benefits. They will have the opportunity to ask questions, and their consent will be documented in writing. They will be informed that they can withdraw their cat from the study at any time.

* 1. What do you intend to tell the participant/s about the purpose of your research?

Owners will be informed that the research aims to develop an AI-powered system for early stress detection in Sphynx cats which improves their overall well-being. They will be told about the collar’s functions and the data it collects. They will not be given any information that may influence the data collected.

* 1. Are there any other potential ethical issues raised by your proposed research activity? If so, please detail them.

Potential ethical issues, including over-reliance on technology diminishing human observation, misuse of data for commercial purposes without consent, the long-term effects of constant monitoring on animal behaviour, and the stress caused by AI false positives, will be addressed through transparent communication with owners, strict adherence to data privacy regulations, and ongoing evaluation of the system’s impact on animal welfare.

# 8.0 CONCLUSION

SphynxSense System is a revolutionary AI-powered pet health monitoring system, tailor-made to meet the specialized needs of Sphynx cats. Utilizing real-time biometric and temperature monitoring, this cutting-edge solution delivers an objective, precise, and non-invasive stress detection approach, beyond the constraints of general behavioural observations. The combination of sophisticated AI algorithms, intuitive software, and ergonomic hardware guarantees timely interventions, the long-term objective being enhanced feline welfare and solidified human-pet bonds. Breed-dependent optimization, system scalability, and commercial feasibility place the system at the forefront of the emerging market of intelligent pet care solutions.

Its success, however, depends on resolving technical issues like the accuracy of data and battery longevity, along with ethical issues of data privacy and the effects of round-the-clock monitoring on the behaviour of animals. In complying with legal and ethical standards, the SphynxSense System not only enhances pet health outcomes but also provides an example of responsible innovation in veterinary technology. To the future, the potential for this technology to be introduced into other breeds and to incorporate additional health metrics promises even more thrilling contributions to animal welfare. As AI transforms pet care, the SphynxSense System is a beacon of the revolutionary difference that technology can make in the pursuit of happier, healthier lives for our cats.

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# 10.0 APPENDICES

## 10.1 GROUP ORGANIZATIONAL CHART



## 10.2 CONSULTATION FROM WORKSHOP LEADER



## 10.3 REHEARSAL

