# Problem statement

**1.1 Historical Introduction**

The initial investment of horse ownership averages between $1,000 to $8,000 depending on the type and purpose of the horse [1]. According to the American Association of Equine Practitioners (AAEP), the minimum annual cost of care for a healthy horse is approximately $1,825 [2]. Due to these expenses by the horse owner, maintaining a horse’s health is imperative. An emergency veterinary bill can range anywhere from a few hundred dollars to well over $10,000.

The Horse Health Monitoring system would aid veterinarians and horse owners alike by providing quicker and easier access to viewing the horse’s vitals such as pulse rate and body temperature. These are two leading indicators of a horse’s overall health. Some common conditions that lead to surgical operations and/or death are colic, lameness, and respiratory infections. These conditions all have symptoms which can affect pulse rate and body temperature. Colic is a condition in which an issue arises in a horse’s digestive tract. There are two main forms of colic. One form, called spasmodic colic, is caused by an accumulation of gas in the colon which leads to acute abdominal pain. The other form is called impaction colic and can have a variety of culprits such as internal parasites, dehydration, a benign tumor in the gut, and excessive ingestion of sand. Impaction colic causes a drop in body temperature as the disease worsens and all forms of colic cause an abnormally high pulse rate of over 50 beats per minute [3]. Lameness in a horse is defined as “an abnormal stance or gait caused by either a structural or a functional disorder of the locomotor system” [4]. Common causes of lameness are trauma, infection, metabolic disorders, acquired disorders, and infection. Any type of infection in a horse will cause an increase in body temperature, to include respiratory infections as well as other diseases.

The current methods to obtain a horse’s vitals are time consuming and potentially dangerous. Pulse rate is measured by hand either under the jowl, under the girth (armpit), or on a vein close to the hoof. To accurately measure a horse’s temperature, it must be performed rectally. A large thermometer is inserted in the horse’s rectum and must have a string attached and tied to the tail so it does not get loose or “sucked in” during measurement. In the event the horse defecates unexpectedly, the process must be repeated. A person obtaining a rectal temperature of a horse is at risk of being kicked by the horse which could cause bone fractures and bruising at a minimum. The Horse Health Monitoring system would obtain these vitals automatically and repetitively to eliminate the risks involved for personnel obtaining these measurements as well as expedite the process tremendously.

**1.2 Market and Competitive Product** **Analysis**

The Horse Health Monitoring system would primarily be used by veterinarians and owners of higher end horses such as those used for competition or breeding. According to a 2013 U.S. veterinary workforce study performed by the American Veterinary Medical Association (AVMA), there is an estimated 9.2 million horses in the U.S. Of these horses, 845,000 are used for racing, 2.7 million are used for showing, 3.9 million are used for recreational purposes, and 1.75 million are used for other activities. In the state of Mississippi, there are 27,200 households that own horses. Nationally, there are 2,137,800 households that own horses [5]. As a result, there is a high demand for cost effective health care options for horses as well as other equine industries.

One solution veterinarians and horse owners look to when a horse begins to exhibit signs of illness, is to place a wireless home video security system in their barn facilities to monitor physical signs of the horse. An example of these systems is Saddlebrook BarnCams. This particular system can range between $449 to $999 depending on selected options. This system has audio and video capability and can transmit 500 feet, 1000 feet, or up to 1 mile. It allows the user to view barn cameras from a television in their home. These types of systems are advantageous because they allow users to monitor their horses from the comforts of their homes and most systems store recorded data for users to examine at their convenience. Some disadvantages of these systems that the Horse Health Monitoring system would compensate for are the inability to track actual information regarding the horse’s vitals. In the event the horse appears to be worsening, the horse owner or veterinarian would still have to physically assess the condition of the horse in person. The range of the Horse Health Monitoring system would be approximately 1300 feet and vitals gathered would be transmitted to a mobile application where the user could track multiple horses and monitor fluctuations of vitals over a period of time [6].

A more comparable system to the Horse Health Monitoring system is the Trackener. The Trackener system is affixed to either a girth sleeve which straps under the horses chest, directly behind its forelegs, or to a horse bib which goes across the front of the horse’s chest. The Trackener monitors the activity level and heart rate of the horse and integrates the data collected into a mobile application for the user to view. This is the only data currently available about the system currently and it is set to launch sometime in 2017. A missing element to a horse’s overall health of this system is the body temperature of the horse. This is one of the most important indicators of a horse’s health that the Trackener does not deliver that the Horse Health Monitoring system would. In warmer months, the girth sleeve and bib placement could potentially cause the horse to be hot and slightly uncomfortable. The Horse Health Monitoring system would be placed on a less invasive strap to go around the horse’s neck. Also unkown about this device is the cost and range [7].

Another similar system is called the Nightwatch. The Nightwatch advertises that it monitors heart rate, respiratory rate, activity, motion, posture, and location. It is also set to be released sometime in 2017 and has an introductory price listed at $499.99. However, this is not the only cost associated with the Nightwatch. Due to the cellular and WiFi technology it uses to transmit data, the user must also purchase an annual monitor contract and license which costs $329.99 a year. The Horse Health Monitoring System would utilize high range Bluetooth technology in order to avoid any cellular data charges incurred by the user. Also, the Nightwatch system only has the capability to track a single horse at one time, whereas the Horse Health Monitoring system would be able to track multiple horses and sync data to the user’s mobile application [8].

**1.3 Concise Problem Statement**

Horse owners and veterinarians need an affordable and efficient system to monitor the key vitals of a horse’s health so that they may respond quickly and appropriately to any signs of illness the horse may exhibit.

The Horse Health Monitoring system will provide accurate and timely measurement of a horse’s temperature. The normal rectal temperature of a horse is 99.5◦F to 101.5◦F (37.5◦C to 38.6◦C). It will also acquire a horse’s pulse rate which is normally 32 to 36 beats per minute for an adult horse. These data will be collected every 30 minutes or upon user command and transmitted via Bluetooth to a user-friendly mobile application for the horse owner or veterinarian to keep track of any changes. It will also send an alarm to the user in the event the horse’s vitals are out of user specified limits. The Horse Health Monitoring system will be placed on a strap that goes around a horse’s neck so that it will be non-invasive and comfortable for the horse to wear. The mobile application will be able to sync to multiple devices. The overall goal of the Horse Health Monitoring system is to provide customers with a simple, efficient, and cost-effective method to keep track of their horse’s health.

**1.4 Implications of Success**

If all goals are met, the Horse Health Monitoring system will significantly improve the expediency of acquiring a horse’s vitals for horse owners and veterinarians and allow them to quickly view any fluctuations in a horse’s health. Measuring rectal temperature will be an outdated practice and a relief for the person performing the measurement. The system will also save a tremendous amount of time to perform a pulse rate measurement. Both of these automated processes will also reduce the risk of injury to the horse owner and veterinarian in the event a horse is not agreeable or not quite as tame as other horses.

Overall, the Horse Health Monitoring system will improve the quality of health care for the horse by enabling quicker response time of its owner. It will enable the owner to better track the horses health to determine if a veterinarian is necessary or if the veterinarian cannot wait which, in turn, will save the owner on unnecessary expenses.

**References**

[1] Cost Helper. (N/A). How Much Does a Horse Cost? [Online]. Available: <http://pets.costhelper.com/pet-horse.html>

[2] Tom Lenz. (2008, July 29). Horse Health: The "Unwanted" Horse in the U.S. [Online]. Available: <http://www.aaep.org/info/horse-health?publication=942>

[3] Pet MD. (N/A). Colic in Horses. [Online]. Available: <http://www.petmd.com/horse/conditions/digestive/c_hr_equine_colic>

[4] Stephen Adams, James Belknap. (N/A). Overview of Lameness in Horses. [Online]. Available: <http://www.merckvetmanual.com/musculoskeletal-system/lameness-in-horses/overview-of-lameness-in-horses>

[5] American Veterinary Medical Association. (2013, April 16). 2013 U.S. Veterinary Workforce Study: Modeling Capacity Utilization. [Online]. Available: <https://www.avma.org/KB/Resources/Reports/Documents/Veterinarian-Workforce-Final-Report-LowRes.pdf>

[6] Saddlebrook Barncams. (N/A). Wireless Camera System Metal , Stone or Wood Barns. [Online]. Available: <http://barncams.com/product/wireless-camera-system-metal-stone-or-wood-barns/>

[7] Trackener, Act Sooner. (N/A). Trackener: Detect. Prevent. Learn. [Online]. Available: <http://www.trackener.com/index.html>

[8]Nightwatch: Equine Distress & Wellness Monitor (N/A). You’ve Got Questions, We’ve Got Answers. [Online]. Available: <http://www.nightwatch24.com/faq/>