# Problem statement

**1.1 Historical Introduction**

The first known instance of domesticated horses in history was 5000 BCE in Central Asia where they were grown for meat and milk. Horses eventually were seen for their potential around 4000 to 5000 years ago. Evidence indicates humans had learned to ride them as well as use them with chariots. Roads were built and trade routes were established utilizing horses as a means of transporting goods and information between cities. Soon, with the development of stirrups and saddles, horses were engaged in warfare as well [1]. The importance of horses in society was crucial. In America in 1915, the horse population had reached around 20 million. The industrial revolution and the age of the automobile, however, caused the need for horses to plummet as well as their population. By 1960, there were only a few million left in America [2]. As machines and technology replaced the horse’s brute strength and endurance, the role of the horse inevitably shifted to what we know today. The horse has become a great companion to humans and the bond between them has never been stronger; neither has the need to properly care for them.

The most useful tool horse owners and veterinarians have to monitor a horse’s health are its vitals such as pulse rate and temperature. The Horse Health Monitoring system would aid veterinarians and horse owners alike by providing quicker and easier access to viewing these data. Pulse rate and temperature 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 that 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 results in the horse’s loss of use of its lower extremities. 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 [4].

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 are 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, 27,200 households own horses. Nationally, 2,137,800 households own horses [5]. The initial investment of horse ownership averages between $1,000 to $8,000 depending on the type and purpose of the horse [6]. According to the American Association of Equine Practitioners (AAEP), the minimum annual cost of care for a healthy horse is approximately $1,825 [7]. A single emergency veterinary bill can range anywhere from a few hundred dollars to well over $10,000. Due to these expenses incurred by the horse owner, maintaining a horse’s health is imperative and as a result, there is a high demand for cost-effective health care options for horses as well as other equine industries.

A comparable system to the Horse Health Monitoring system is the Trackener. The Trackener system is affixed to either a girth sleeve that straps under the horse’s chest, directly behind its forelegs, or to a horse bib that 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 available about the system currently, and it is set to launch sometime in 2017. The Trackener system lacks the ability to monitor a horse’s body temperature, which is one of the most important indicators of a horse’s overall health. 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 unknown about this device is the cost and range [8].

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 be around half of this cost, although it will also utilize cellular interfacing. 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 send each horse’s data to the user’s cell phone [9].

**1.3 Concise Problem Statement**

Horse owners and veterinarians need an affordable, efficient, and safer 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. Not only is horse ownership costly financially, but any illness or death of a horse is emotionally taxing on the horse owner due to the strong bond of companionship. Early detection of any signs of ailment will help reduce both the financial and emotional costs of the owner.

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 measure 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 the Global System for Mobile communication technology (GSM) to the user, 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 measuring 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 the horse owner and/or veterinarian 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 the horse owner. It will enable the owner to more efficiently track the horse’s health to determine if a veterinarian is necessary or if veterinarian response is critical, which, in turn, will save the owner on unnecessary expenses and potential heartbreak. The Horse Health Monitoring system will take the worry from the horse owner and allow them to simply enjoy the companionship of their equine counterpart.

**References**

[1] Kahn Academy. A Little Big History of Horses. [Online]. Available: <https://www.khanacademy.org/partner-content/big-history-project/expansion-interconnection/other-materials8/a/a-little-big-history-of-horses>

[2] Sushil Dulai Wenholz. (2000 January 1). 100 Years of Horse Health Care. [Online]. Available: <http://www.thehorse.com/articles/10234/100-years-of-horse-health-care>

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

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

[7] 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>

[8] Trackener, Act Sooner. Trackener: Detect. Prevent. Learn. [Online]. Available: <http://www.trackener.com/index.html>

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