Product and technology

Product Description & Specifications

PALES aims to provide a comprehensive health-monitoring wearable device and insightful health analytics service for the equestrian market. PALES wearable devices for horses are non-intrusive and provides essential features such as:

- Adverse event monitoring
- Activity recognition and quantification
- Exercise logging
- Health parameter tracking

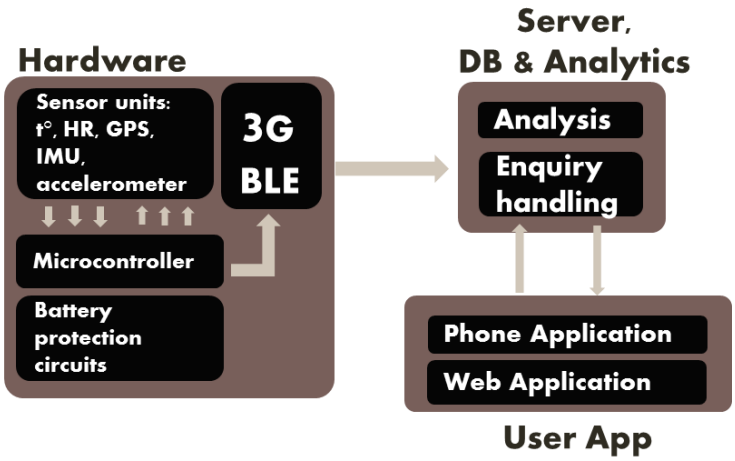
The PALES Equine Health Monitoring System can be classified into two parts: the monitoring device itself and the analytics system running on the server that takes in the data collected from the horse's vital statistics and converts them into meaningful information.

PALES wearable device is complemented by a smartphone app that provides an intuitive interface to the end user to make the best use of the monitoring system.

Our system provides insightful data visualization for the end user to easily understand and make best use of the data at hand. The app would also suggest best practices to follow based on the data accumulated. The activity levels and health parameters mentioned above are actively tracked over extended periods and the data is stored in individualized cloud-based user accounts.

Active tracking would enable the horse-owner to better understand their ward's needs and are especially effective in conditioning and training for competitions and monitoring its general well-being.

On the right is the schematic of the product setup.



Hardware

Mounting & Dimensions

The Device, just like the previous prototype, will be mounted on the inner part of a horse tail, which is where there is an exposed patch of skin and a major artery flows.

Max Dimensions: 10cm x 5cm x0.5cm

Max weight: 300g

Components & Features

Safety

- →Waterproof
- →Heat sensor for battery safety
- →Antibacterial coating
- →Extra hard plastic shell

Core parameter tracking

Movement

- →accelerometer
- →GPS & IMU

Physiological

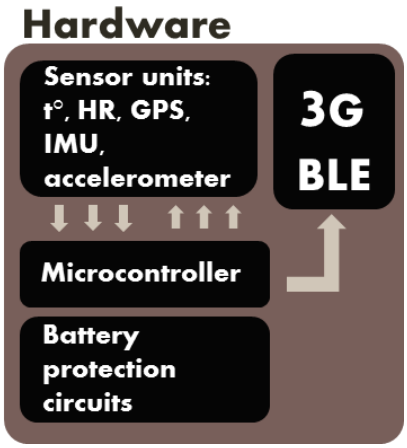
- →t° (infrared thermometer)
- →Heart Rate Monitor

(Near) Real Time Communication

- → Bluetooth low energy module
- → 3G module

Battery management

- → Replaceable 7.4V 1200mAH Lithium-Polymer battery
- →STM32L series microcontroller (ultra low power)
- →SD card for bad network conditions



Hardware process flow

The microcontroller sends instructions to the sensor units and receives data readings from the sensor units.

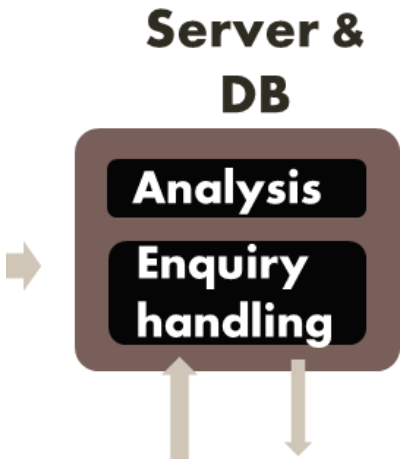
Once readings are received they are either stored in an SD card in case of bad network coverage or sent over via the 3G or BLE modules.

3G/BLE module (depending on the connection available) transmits the data over to a cloud database.

Cloud & Analytics

Database & Server

Database and server act as mediators between the owner and device on the horse.



Database is where the data is stored with the appropriate tags. We use NoSQL locally on the device and Amazon DynamoDB on the cloud.

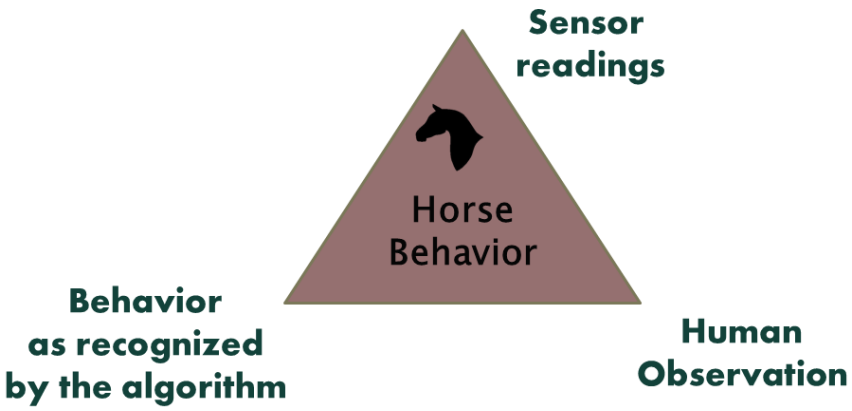
A virtual server is where the enquiry handling and computing are performed.

For the cloud services including database and server, we use integrated solutions provided by the Amazon Web Services, such as the AWS IoT

Analytics

We use WEKA ((Waikato Environment for Knowledge Analysis) classification algorithms, which are open source machine learning algorithms we customize according to the needs.

By giving the algorithm learning data with tags of specific behaviour it learns itself to recognize the specifically tagged behaviour (e.g. eating, sleeping, anxiety) in the future based on the sensor readings. We use two level classification for tagging:



First level: Location (GPS/IMU data)

Second level: Activity (Accelerometer, HRM, t°)

The tags are added manually at first by coupling the sensor data with human observations and cross-validated/fine-tuned for individual horses with customers.

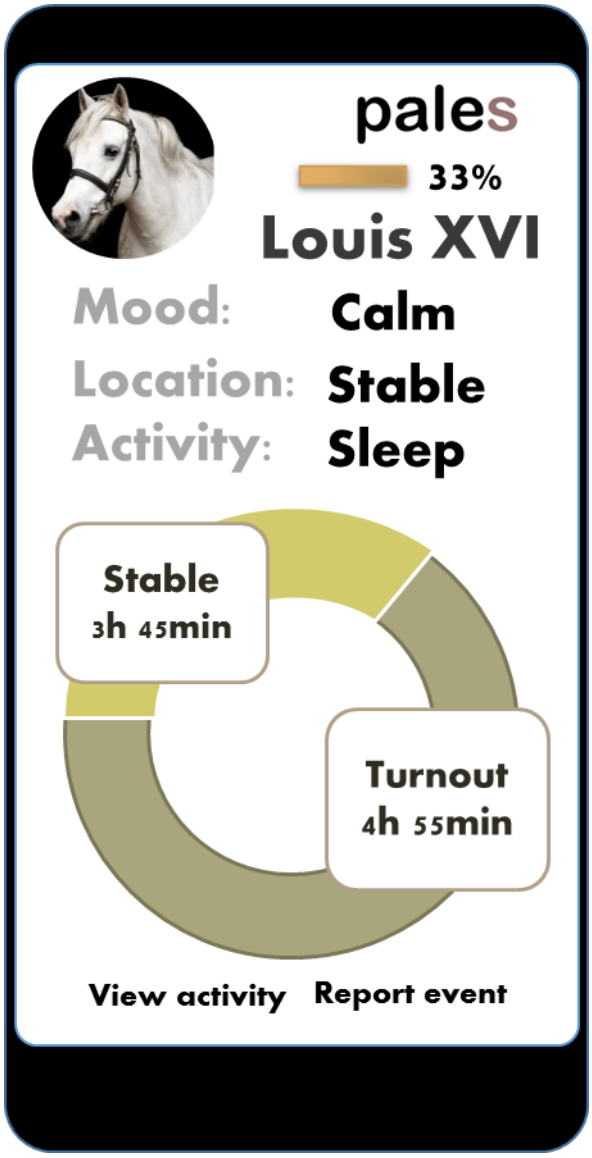
User End Mobile App

Basic Features

The mobile app will break down the activity data of the horse based on location and activity.

By clicking on the place on the circle, the totals and breakdown of each activity are displayed.

The owner can set the amount of notifications it gets, based on her interest. Potential notification worthy activities include: returning to stable, turning out, feeding, waking up.



Cross-validation

When the expected accuracy drops below 90%, the owner is given a pop up window for double-checking/identifying the activity of the horse.

Sharing with vet & coach

When the owner registers his account, the access to the horses profile can be shared to 3 other Pales users at no extra cost.

Adverse event monitoring

When an extreme measurement is noticed within the specific location (for example: unusually high heart rate/ t" at stable) an alert is sent immediately to the owner and 3 other persons with whom the horse profile is shared.

Web App

The web app will allow the owner to pull full historic information the horse's daily regime from day one. The dashboard will break down the activity in parts on the basis of classification. The current themes requested would be:

Daily regime:

- Eating pattern
- Sleeping pattern
- Activity level throughout the day
- Bowel movement
- Anxiety

Exercise:

- Exercise intensity level and time
- Weekly exercise regime
- Mapping condition over time (heart rate)

Technology Value Proposition

Benefits

- Full activity mapping
- Sense of Security
- Detect recurrent behavioral patterns
- Overall assessment of the condition of the horse
- immediate feedback in changing the lifestyle

Features

- Pulse/heart-rate & t° monitoring for vets
- Movement/Gait tracking and speed for coaches
- Foaling Prediction for pregnant mare owners
- Adverse Event monitoring for risk groups

Why Pales?

- Precise and timely monitoring
- High reliability
- Interactive
- Hardware-software co-design
- Unique and unobtrusive design

Unique User Experience

- Real-time feedback on activities performed
- Monitoring from afar
- Dedicated customer support
- Dedicated assistance on per event basis for premium customers

Product Roadmap

IP Strategy

Introduction

There are two potential categories of intellectual property within this business: hardware and software IP.

Since we are using existing sensor modules an assembling them together, we cannot file for any patents on the hardware. However, currently we are filing a provisional patent for mounting the device on tail, which would secure some physical IP.

IP long term strategy

In terms of IP and value added, we aim to have analytics being our truly distinguishing factor. As a consequence, as we develop new, equine specific methods we aim to register patents in the realm of data handling and/or processing methods.

A good example on which a series of patents could be developed is that of the transfer between the population and individual horse data. Because a horse is an individual that is part of a group with similar features, there will be ways to transfer specific knowledge of adverse events among the group towards recognizing it in an individual horse, who may have never experienced such event. The methods of recognizing such events in an individual horse could be patented.

Provisional patent on the position of the sensor

The device is mounted on the horse by using leather straps, elastic bands, or any other stabilizing method that are attached to the sensor, which faces the uncovered skin patch on the inner part of the animal's tail. The device, also having the ability to do wireless communication, is attached to tail with the purpose to collect enough biometric information of the animal.

Because mounting of the biosensor can have a significant impact on the quality and reliability of biometric data as well as the comfort level for the animal, we have decided to get a functional patent on the unique position of the device when mounted on the animal. Existing biosensors for livestock health monitoring are often mounted in three areas: neck in a form of collar, chest in a form of girth and leg as tied with a strap to the lower tendon. Below find a comparison of methods:

	Chest & Back	Leg	Neck / Halter	Tail
				
Mounting surface to sensor area	**Large**	**Small**	**Small**	**Extra Small**
Unlikely to cause friction as the horse moves	**No**	**Yes**	**No**	**Yes**
Does not interfere with other tack	**No**	**No**	**No**	**Yes**
Horse can't remove/damage it with teeth	**No**	**No**	**Yes**	**Yes**

To sum up the table above there are several advantages to mounting a biosensor on the tail:

The spine of most vertebrates including horses do not possess the flexibility to fold completely, therefore mounting bio-sensing device on this part of the animal can prevent it from making any actions to remove the device. This could be a potential issue for mounting the sensors on girths and/or legs of the animal.

Furthermore, while existing devices are mounted on body parts such as neck, back, or limbs, this installation method has better physical stability as there is little to no friction with the skin or muscles as the animal moves. This is a significant improvement from collars, girths and leg belts, which are all positioned in areas, where the potential of displacement and therefore less reliable measurements caused by the movement of the animal are higher.

Finally, the relative surface area ratio of the sensor and the mounting support is much smaller than in the case of waist-girth and neck collar. The surface area carries importance for long term monitoring, where less potential for skin irritation and less restrictions on the freedom of movement are strongly preferred.