

# USE OF SENSORS (ACTIVITY METER) IN DAIRY HERDS (Level 3)

Topic	Training & information Content
8.1	Farm structures & housing cows/calves/young stock
8.2	Construct small zero grazing unit (SNV handbook)
8.3	Prevention of heat stress in cow barns
8.4	Cow house ground floor plan design (SNV book)
8.5	Best management practice feed fences
8.6	Housing & cow comfort (animal welfare)
8.7	Housing & reduction greenhouse emissions
8.8	Use of sensors (activity meter) in dairy herds



## 1. You will learn about (learning objectives):

- What is a sensor/activity meter?
- What are the benefits of using sensors on your farm?
- How economical is the use of sensors?
- Examples of activity meters/ sensors in a dairy farm?



## 2. Background

- Activity monitoring technology is beneficial to both you and your cows. Activity monitoring can help dairy farms of all sizes maximize their labor and resources, a smart investment at any milk price.
- Maximizing resources is critical when margins are tight and activity monitors can do just that.
- Activity monitors can detect and identify increased activity due to heat, heat behavior, unusual behavior, signs of diseases (e.g. somatic cells count), and rumen activity, allowing you to reallocate labor resources elsewhere.
- An added bonus is that they show more than the human eye can see and never call in sick for work.
- The activity meters however at times depend on electricity or wireless connectivity to exchange data with computer software.



### 3. Introduction

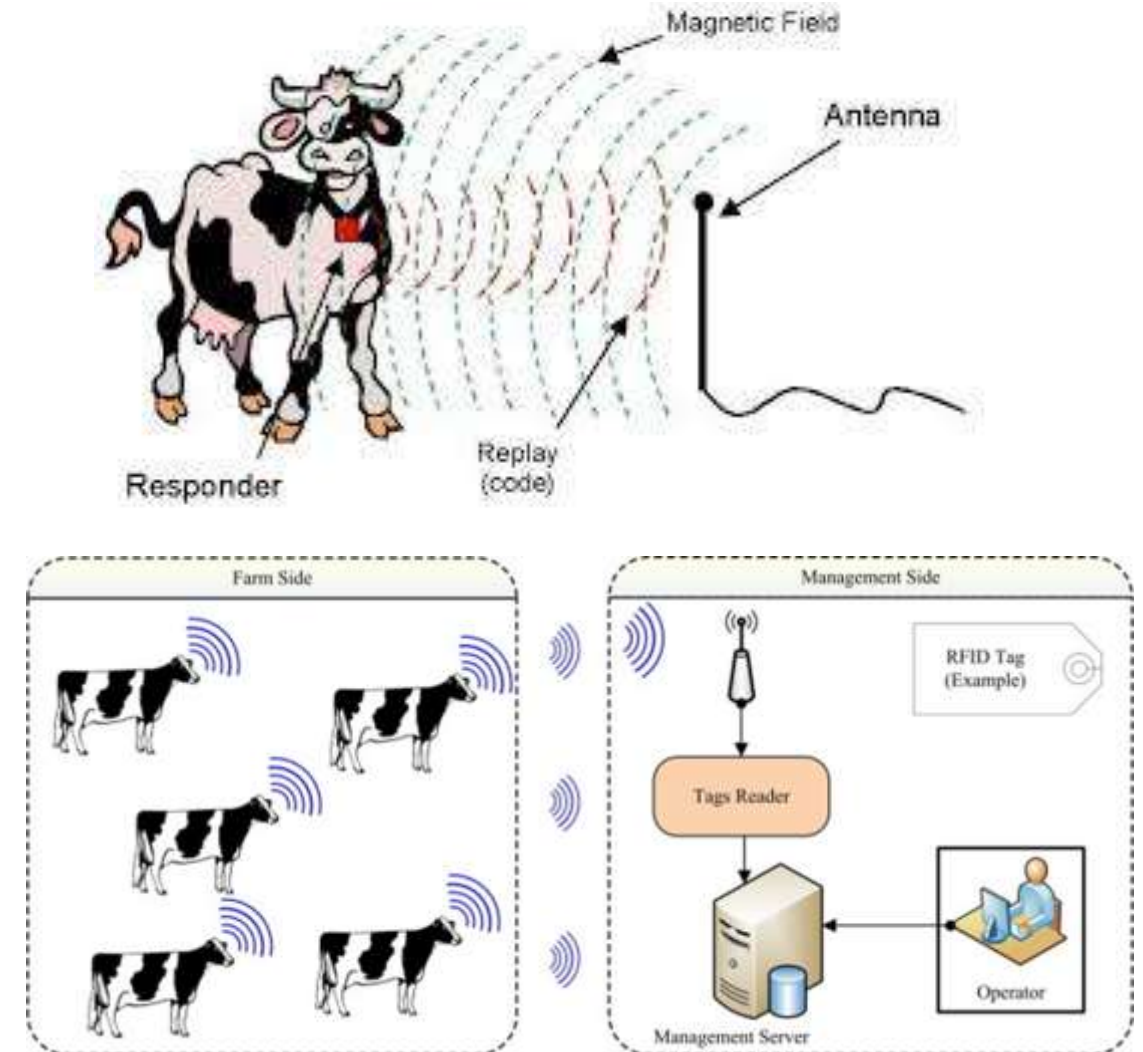
- There is growing interest in the use of activity monitoring systems on dairy farms.
- This interest is driven by the desire to improve reproductive performance or stabilising rumen activity, reduce labor, and reduce the cost of production.
- This may lead to a reduction of time needed for three times daily heat detection and may give in case of rumen activity early warning of a deviant pattern.
- More and more companies are entering this market and targeting East Africa. For Example, Afimilk, Uniform Agri, Ida conecterra, Nedap etc.





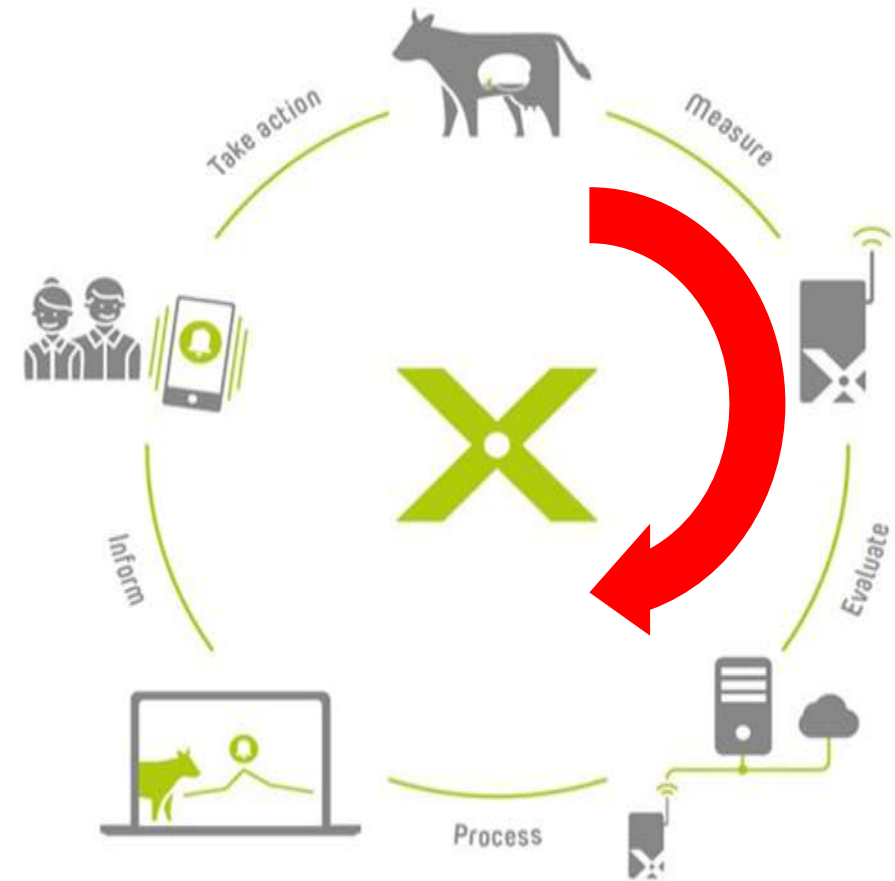
## 4. What do the activity meters/sensors consist of?

- The systems typically consist of three main parts;
  1. An activity tag containing a pedometer or accelerometer attached to the leg, ear, or a collar on the cow's neck;
  2. An antenna to read the activity tag; and
  3. A computer or phone with software that allows the dairy farmer to enter information into the system and view output from the activity tags.



## 5. How the sensors/activity meters measure and the systems works

- The activity tags measure cow activity or movement.
- The computer takes this information and compares it to previously collected data to determine when a cow's activity is increasing or decreasing.
- The activity data is presented to the farmer in tables and graphs, and typically the number of hours until ovulation or an optimum time to insemination is also shown.



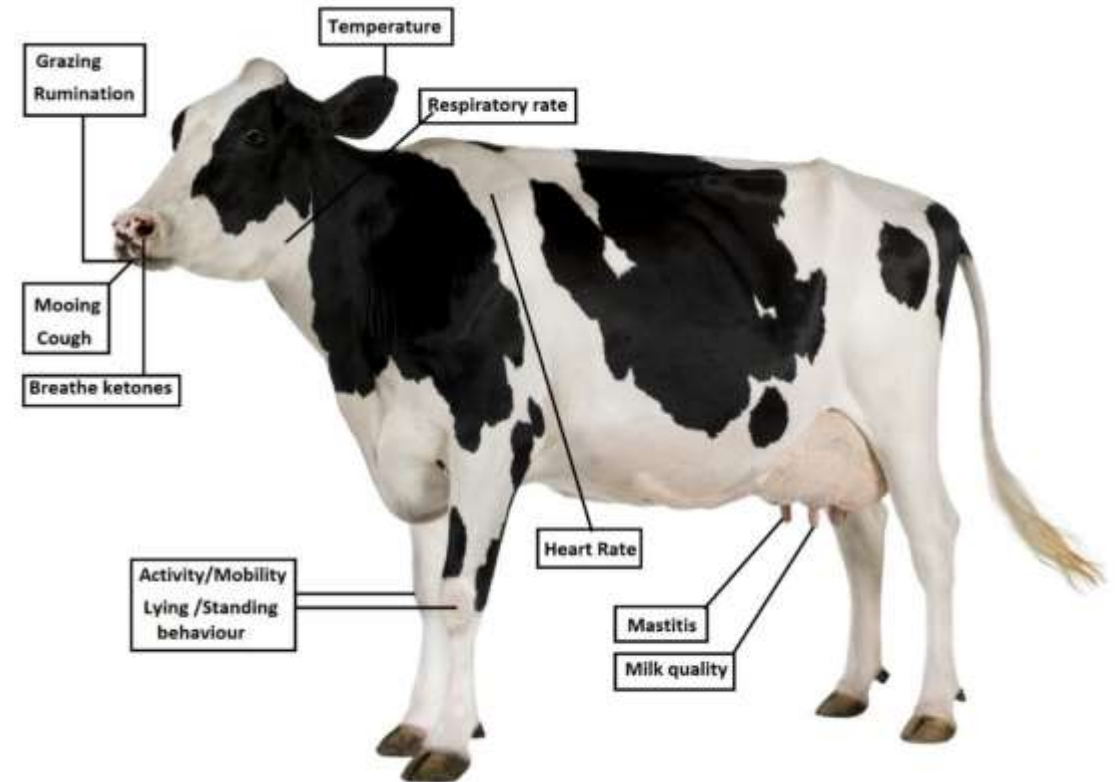
## 5.1. How the sensors/activity meters measure and the systems works. Cont'd...

- In addition to activity many of these systems also monitor cow temperature, eating time, rumen function, and cow position (standing vs. lying).
- Cow activity and these other measurements are often combined to provide an overall indication of cow health.
- Some systems also allow the dairy farmer to locate a specific animal in the barn.



## 6. Benefits of the sensor/activity meter in a dairy farm

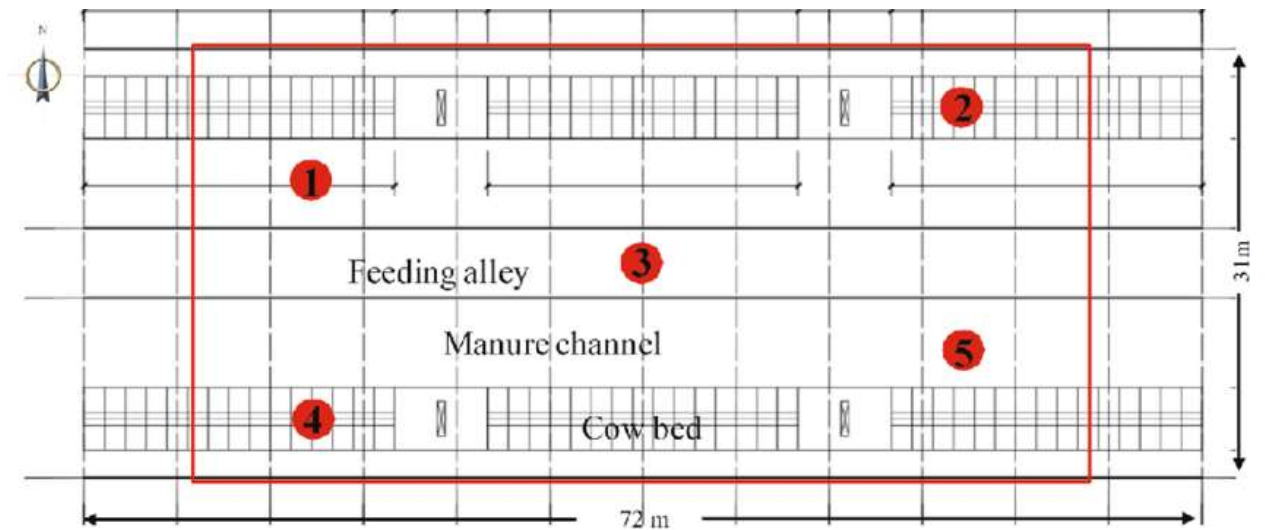
1. Improved labor efficiency,
2. Accurate record keeping and real time decision making,
3. Gives indication at an early stage of a health issue arising which can lead to a reduction of health issues and associated cost,
4. Higher detection rate of heat (cycling) if acted upon this heats this may improve conception rates,
5. Improved cow comfort (analysis of standing vs. lying),
6. All these points together may improve the productive performance and sustainable herd.





## 6.1. Improved labor efficiency

- Activity monitoring tracks what her location in the cow barn is, what each cow is doing in other words the intensity, and frequency of movement and relates this information to the phase in which the cow is in her heat cycle.
- Instead of spending time checking for heat and herd health or trying to locate a cow, the farmer and his staff can spend more time on other important management areas and family.



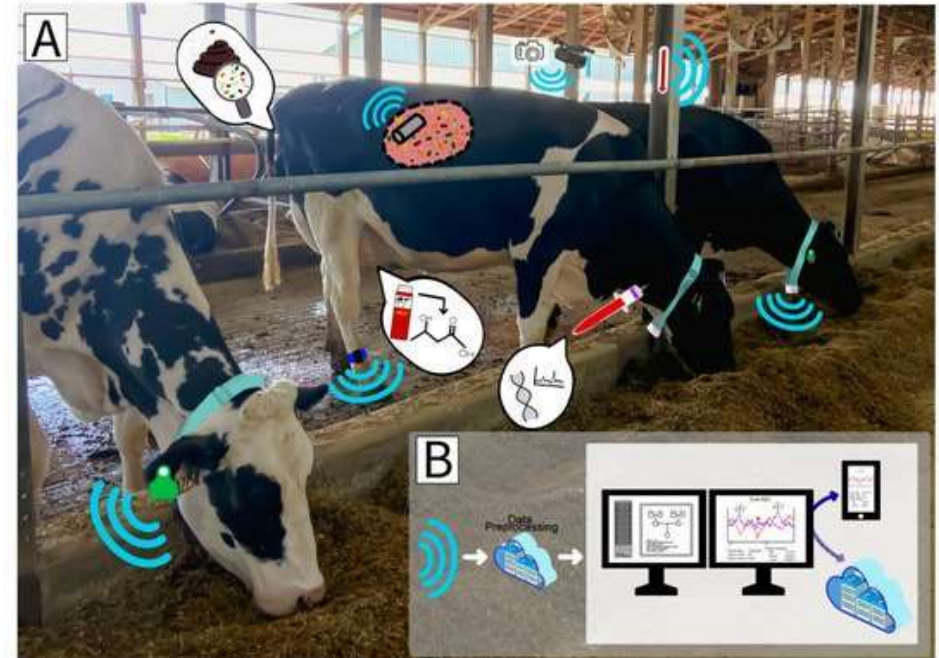
## 6.2. Accurate record keeping and real time decision making

- Activity monitoring accurately records individual cow and group behavior.
- It offers insight at any time and takes the guesswork out to make better decisions based on data analysis.
- If an action needs attention, an alert is triggered. Immediate steps can be taken to correct the situation.
- An activity meter records data, this data can be useful information for the farmer.
- The data through the software are presented to the farmer on the screen in a graph or a tabled overview.
- Through frequent use, the farmer understands how to translate the information into practical changes to the situation.



### 6.3. Reduced health issues and associated cost

- Some systems can monitor eating, rumination, movement, or inactive behaviors.
- They can detect the signs of diseases like ketosis, increase in somatic cell count in milk, subclinical mastitis, and pneumonia a few days before their symptoms are visible to the human eye.
- This allows the farmer to give timely treatment to sick cows or to correct incorrect and or imbalanced rations.





## 6.4. Improve conception rates

- Dairy farms with well-managed activity monitoring systems see improved conception rates.
- The sensors identify cows in heat which makes it easier to predict optimal breeding time more accurately, which increases the chance of conception when inseminating.
- As a result, pregnancy rates increase, and calving intervals reduce.





## 6.5. Improved cow comfort

- Activity monitoring systems provide herd performance trends that show the impact of adjustments in housing, handling, and nutrition. By doing so, they can positively influence cow comfort.
- The use of sensors enables the farmers to know exactly which cows require special attention and, equally important, which ones don't.
- A stress-free environment can be offered to them, without their routines being disturbed.



## 6.6. More productive and sustainable herd

- Due to improved fertility dairy farmers can achieve higher peak production per cow.
- Early detection of health issues prevents unnecessary loss of milk production and extends your cow's life span and number of lactations.
- This way, the farmer get more value out of your cows and more milk in the cans.



## 6.7. More time to enjoy the farm, less time on the telephone

- Activity monitors are constantly watching over the herd, giving you the confidence to leave the farm and participate in other activities that are important to you and your family.
- Using actionable data helps you better your best. Making the most of the activity monitoring technology available to you will bring these seven benefits to life.
- Large scale farms using sensors report that it only takes 1-3 years for the technology to pay for itself. And that doesn't account for the peace of mind you get with the system.





## 7. How long will it take to pay the cost of the system?

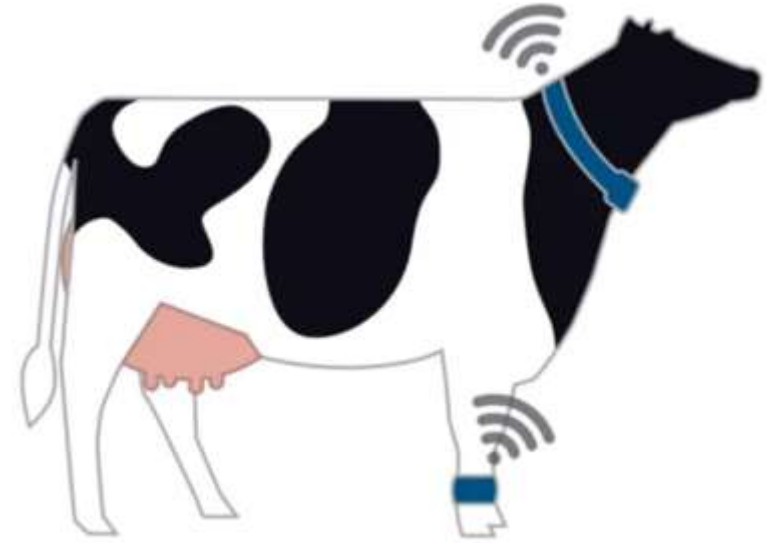
- The actual time will depend on the existing reproduction program and how well the dairy is able to integrate the new technology into their management system.
- Some of the areas where dairy farms obtain cost savings with the introduction of an activity system include:
  - decreased time for observing standing heats,
  - decreased hormone costs (synchronization),
  - less time and labor spent on implementing hormone programs,
  - inseminations and,
  - decreased semen costs.





## 7.1. How long will it take to pay the cost of the system? Cont'd...

- Revenue generation from an activity system can come from an earlier age at first calving, decreased calving interval, and an increased average milk production resulting from a decreased DIM.
- When activity is combined with other measures to provide a health indication, additional savings can be obtained by being able to treat a cow before other clinical signs are observed.



## 8. Which cow to use sensors

- The use depends on how you want to use the system on your farm. For most systems, once the activity tag is on the animal it will take seven to ten days for the system to establish a baseline for that individual cow.
- If you want to use the system only for heat detection, you need enough activity tags so that you can put one on each cow a few weeks after freshening until confirmed pregnant.
- If you want to use the activity tags to monitor cow health around freshening and for heat detection, you need enough activity tags for cows about one month before freshening until confirmed pregnant.
- If you want to use the activity tags to monitor cow health throughout her life or you just do not like the idea of switching activity tags all the time, you need enough tags for the entire herd.



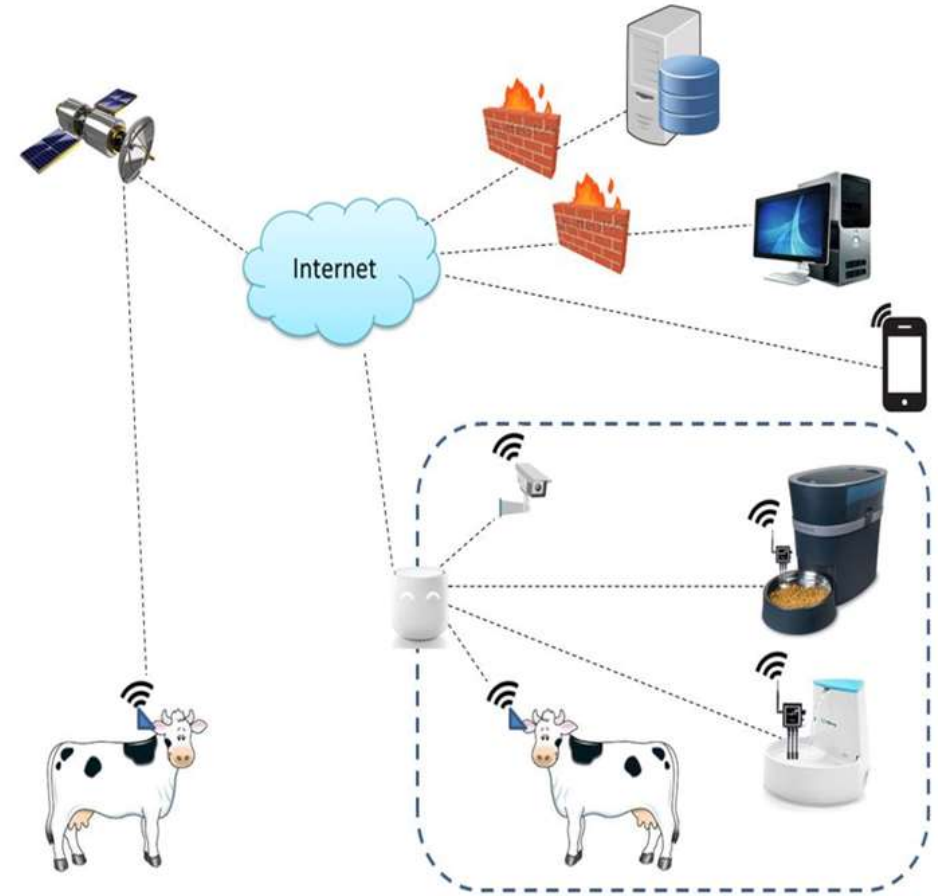
## 9. Question to ask before purchasing an activity meter

- What training is required and which support is provided when using the system?
- How long is the warranty period on the activity meter tags or other system components?
- How large of an area will the tag reader or antenna cover? Will the system be able to read the activity tags in all parts of the barn and or pastures?
- Is there another farm in the area using the system that I could visit(do a benchmark)?



## 9.1. Question to ask before purchasing an activity meter. Cont'd...

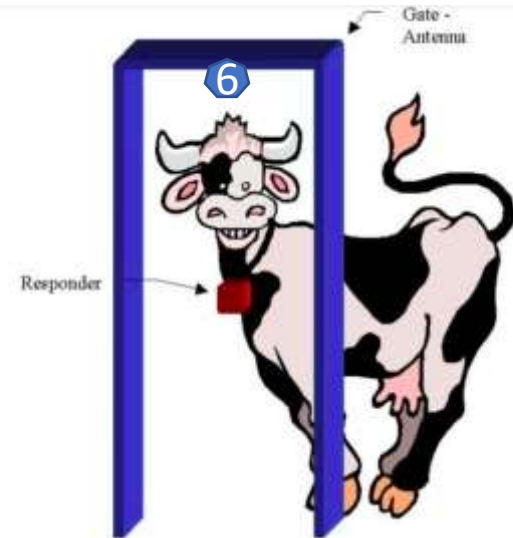
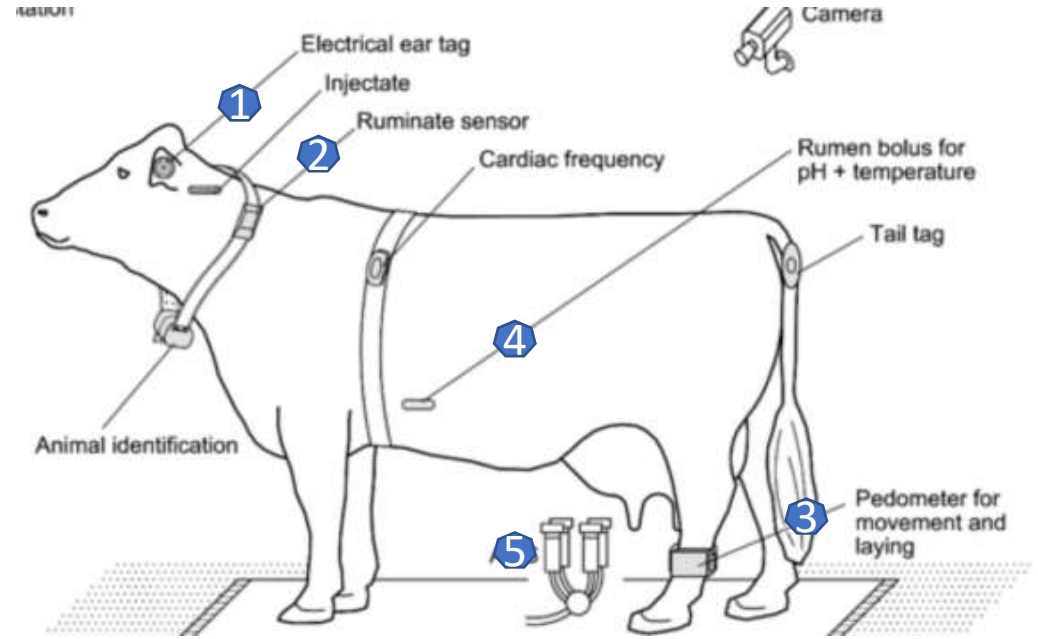
- What is the payback period for the system? Several companies have a payback calculator that allows you to enter information about your current system and provides assumptions about changes that can be expected with the system.
- Is the activity system compatible with my current herd management software?
- Do I need power, a wireless or wired connection, Bluetooth connection, or an internet connection for this system to work?





## 10. Types of activity meters/sensor

- There are several types of sensors for a dairy farm and a farm can have all, some, or one of these sensors installed. The sensors are;
  1. Bluetooth (electrical) ear tag sensor,
  2. Collar/Neck sensors (ruminant sensor),
  3. Leg band activity meter (pedometer for movement and laying),
  4. Rumen bolus activity meter (for PH and temperature),
  5. Milk sensors in milk parlour and,
  6. Sorting gates in the barn.
- These examples are discussed more in the slides that follows.



## 10.1. Ear tag activity meters/sensor

- The Bluetooth Ear Tag sensor sends your cattle's check-in activity to provide you with actionable insights and alerts.
- Spot early signs of decreasing cattle activity around important farm locations like water sources, feeding stations, etc.
- Provide last reported date, time and receiver location to the owner and authorities to with missing, lost/stolen cattle recovery.
- Generate daily cattle count reports.
- Maintain individual cattle data on movement and monitor their activity.



## 10.2. Collar/Neck tag and activity meters/sensor

- The collar/neck sensor is placed around the neck as shown in the picture.
- The number displayed is the cow's tag number. Apart from displaying the tag number, the neck sensor has other unique functions;
  - Constant heat monitoring and display of the optimal insemination time,
  - Notification of reduced eating and rumination frequency and time to enable early detection of health problems,
  - Reliable animal identification in the milking parlour, selection system, sorting gates, locating cows and feeding box.



## 10.2.1 Neck tag sensor for monitoring heats

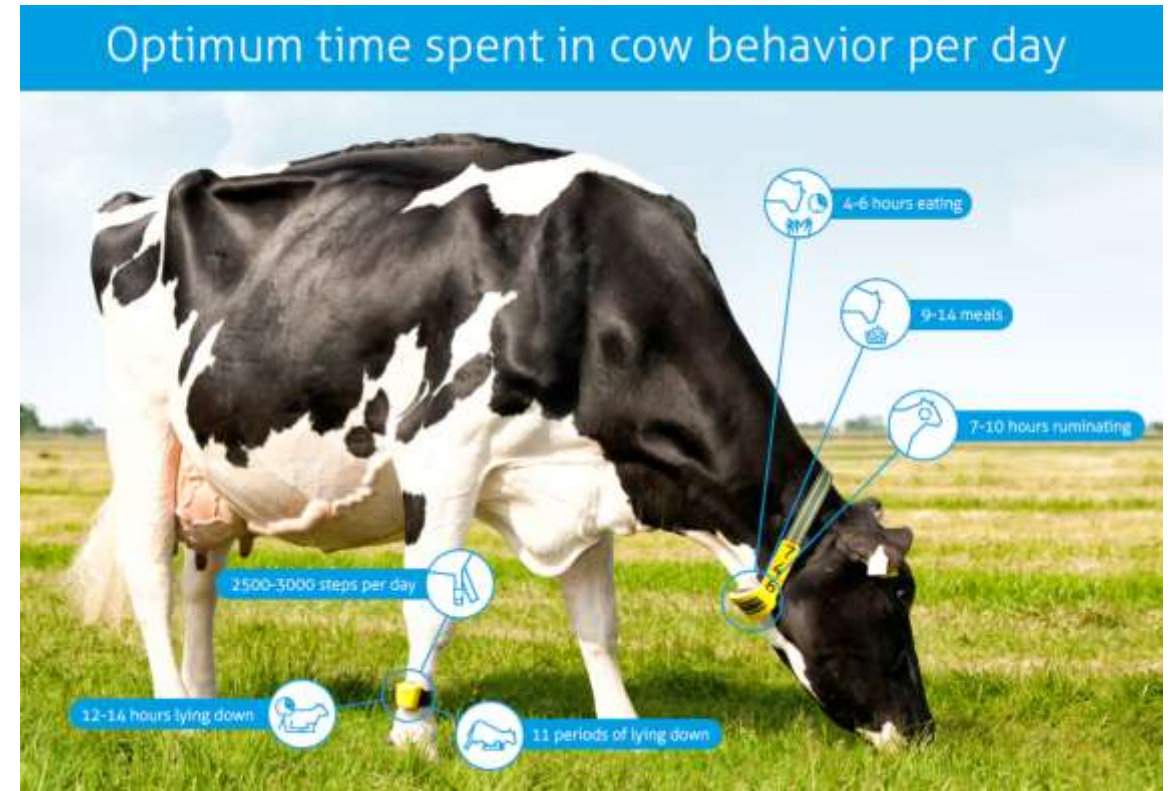
- The sensor works 24 hours 7 days a week to monitor cow activity by identifying neck movements, such as sniffing and chin resting, that indicate if a cow is in heat.
- With this real-time data, cows in heat can be identified, allowing to improve time of insemination resulting in higher pregnancy rates, shorter calving intervals, and reduced insemination costs, all with lower labor inputs.
- The data collected by the sensor will, next to heat detection also optimize fertility management and feeding management of the herd.





## 10.2.2. Neck tag sensor for monitoring feeding management

- The neck sensor detects specific movement patterns related to feed intake, recording the time individual cows spend eating.
- Changes in eating and rumination behavior as well as measurements of activity versus inactivity, may indicate potential health problems.
- The alert function indicates immediately if the cow is exhibiting feeding or health problems, allowing quick and appropriate response .



### 10.3. Leg activity meters/sensor

- The leg sensors work by detecting and monitoring activity levels including cow restlessness (jumping, running etc).
- The sensor can provide early warning of a number of key cow conditions including heat, onset of calving, and can identify cows suffering discomfort due to poor cubicle design (can cause cows to rest less) or lameness.
- Heat can be detected via increased standing time, while restlessness in dry cows could indicate the onset of parturition.



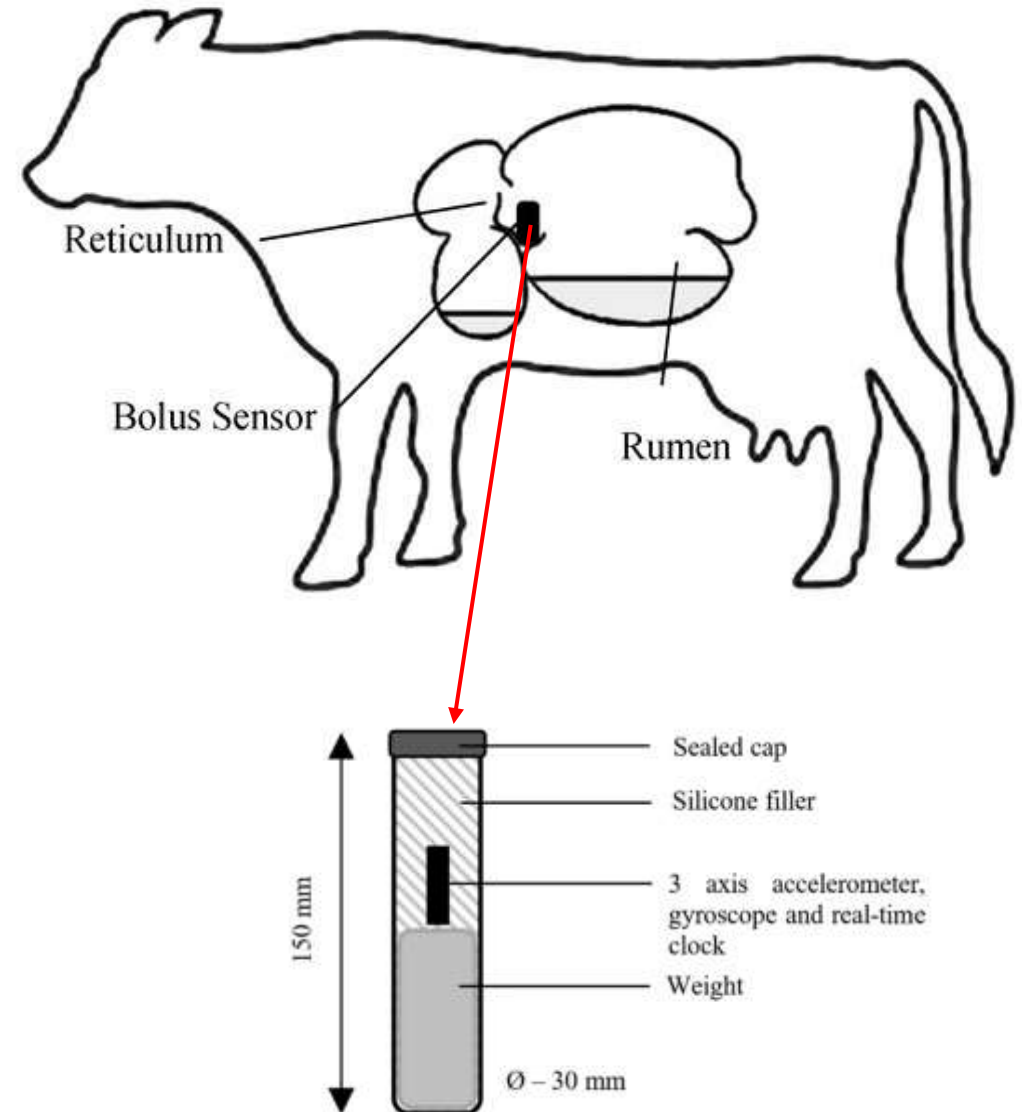
### 10.3.1. Leg activity meters/sensor. Cont'd...

- It can also identify cows suffering discomfort as a result of poor cubicle design, often showing unusual levels of restlessness, while increased lying time and prolonged periods of rest could be a sign of lameness.
- Having early warning of these potential issues enables appropriate preventative measures to be taken to ensure increased or at least continuous milk yields, improved or maintain milk quality, and reduced costs of production through lower veterinary bills.
- At the same time, more accurate data can also result in better herd health and higher standards of animal welfare.



## 10.4. Rumen bolus sensors

- This is designed to provide continuous measurement of ruminal pH and temperature of cows. The recorded data is transmitted wirelessly to the computer/base station in real-time. This requires a backup battery or Bluetooth connection.
- The benefits of PH measurements are as follows;
  - Monitoring and maintenance of rumen health. Early detection of fermentation disorders.
  - Feed management. Increase in feed efficiency (MAFC =Margin above feed costs) due to improved feed conversion.
- Mobilizing unused genetic potential with a ration that has a higher inclusion of concentrates in relation to forage. Resulting in a higher energy density in the ration which may impact animal health (See topics, **3.6. Rumen fermentation & 3.15. Metabolic disorders**);
  - The result of this can increase feed uptake hence increasing milk yield.





### 11.4.1. Rumen bolus sensors. Cont'd...

- It is important to note that the reticuloruminal (construction of the rumen and reticulum) motion is continuous and does not only occur during rumination; hence, a means of differentiating rumination periods from other motions is required.
- The bolus may not be accurate in measuring rumination.
- However, the Collar-based sensors, can identify rumination by monitoring accelerations in the neck muscles associated with the characteristic rhythmic jaw motion.



## 10.5. Milk activity meters in the milking parlour

- The milk activity meters are a unique set of milk sensors that monitor and record the most essential aspects of the milk yield for every cow, during every milking session.
- Milk yield is accurately measured, for early detection of health problems,
- Milk yield data recording makes animal selection (voluntary culling) easier. Effective culling results in increased genetic potential in the long term.
- Milk solids are analyzed with a focus on protein and fat components to effectively detect metabolic health problems such as ketosis, nutritional issues, and digestion-related problems (See topics, **3.6. Rumen fermentation & 3.15. Metabolic disorders**)



## 10.5.1. Milk activity meters in the milking parlour. Cont'd...

- Milk conductivity and lactose content are scanned. Changes in these components accurately indicate mastitis.
- The milk sensors can indicate milk quantity, milk increase, and milk decrease.
- The milk sensors can also aid in farm performance. For example:
  - Early detection and treatment of Ketosis assist to keep fresh cows healthy and productive.
  - Early detection and treatment of mastitis. Prevents loss of valuable production and infection of other cows.



## 10.5.2. Milk activity meters in the milking parlour. Cont'd...

- Detection of blood in the milk. Can prevent blood from entering the milk tank.
- Measures changes in fat components in the milk. Applied at the group level, it provides an accurate indication of SARA encouraging early and effective treatment. Changes to feed should be investigated for groups displaying potential SARA symptoms.
- Due to detection of a decrease in milk yield the farmer can identify feeding problems that may cause this as soon as the next milking session. This is critical since feed is the most costly expense for a farm.
- Genetic planning, the sensors can provide a daily record of milk yield and milk components per cow, which is invaluable information for animal selection planning.





## 10.6. Sorting gates activity meters/sensor

- In a medium and large-scale farms it is labor intensive and stressful to sort cows, for example bringing animals from the barn to the treatment area (hoof care, disease treatment, insemination etc).
- The gates sorting system automates animal sorting by generating, exporting, and importing cows' sort lists or, easily sorting a specific animal in the parlor using a milk-meter keypad, rotary terminal touch screen, or your smartphone.
- The gates work hand in hand with the Identification sensors.

