

Abstract

Problem: In the U.S., more than 29 million cows suffer and die in the meat and dairy industries every year. They are dying due to diseases like respiratory infections, mastitis and ketosis that lead to infertility and low milk production. One of the most serious concerns confronting the dairy sector today is poor health-care management and the inability to detect diseases on time for cows.

Solution: Farm Plus is a real-time monitoring and tracking solution for livestock health and fertility. The technology consists of an ear tag with an IoT sensor worn on the cow's ear. Using a multitude of sensors on a circuit board, this ear tag detects physical characteristics such as movement, sound, and temperature. The IoT, which includes sensors, will map information based on data such as grazing pattern, body temperature, walking pattern, and head drooping. This data is analyzed by our deep learning algorithm, which serves two purposes. First and foremost, detecting anomalies and predicting illnesses at an early stage. Second, predicting the optimal ovulation period for cows so that farmers may effectively use artificial insemination to make the cows pregnant.

Introduction

In dairy industry, 74.8 percent of the cows are victims of involuntary butchering because of poor animal health or management. The cows fall prey to deadly diseases like mastitis, lameness, metritis, displaced abomasum, respiratory diseases, and many more. The farmers are not able to detect these diseases early on leading to infertility in cows and low milk productions. This leads to lower quality and quantity of milk production, additional costs to farmers (who already are working on low profits) and makes the life of our favorite animal painful.

There are a total of 9.4 Million cow heads in U.S. alone belonging to 64,000 farms. Only 10% of the farmers use technology to detect diseases and ovulation. Rest of them, have a manual check-up process in place. But doing this becomes very difficult if the farmer has 500+ cows (which is common in USA). There are other solutions in market for doing this. But, during our research, we found out that the two major issues for the existing solutions not being used in this sector are high prices (an average of \$130/ear tag + one-time installation + software) and non-availability of a user-friendly dashboard with actionable insights.

We are collaborating with stakeholders from dairy associations and farms within the United States like United Dairymen of Arizona, High Desert Milk and Maryland Agricultural Extension in order to make our solution accurate and simple so that even any non-tech savvy farmer can use it and act quickly based on the information provided. We have secured an Indian manufacturer who is willing to manufacture our ear tag for an exclusive cost for bulk orders which gives us a competitive edge.

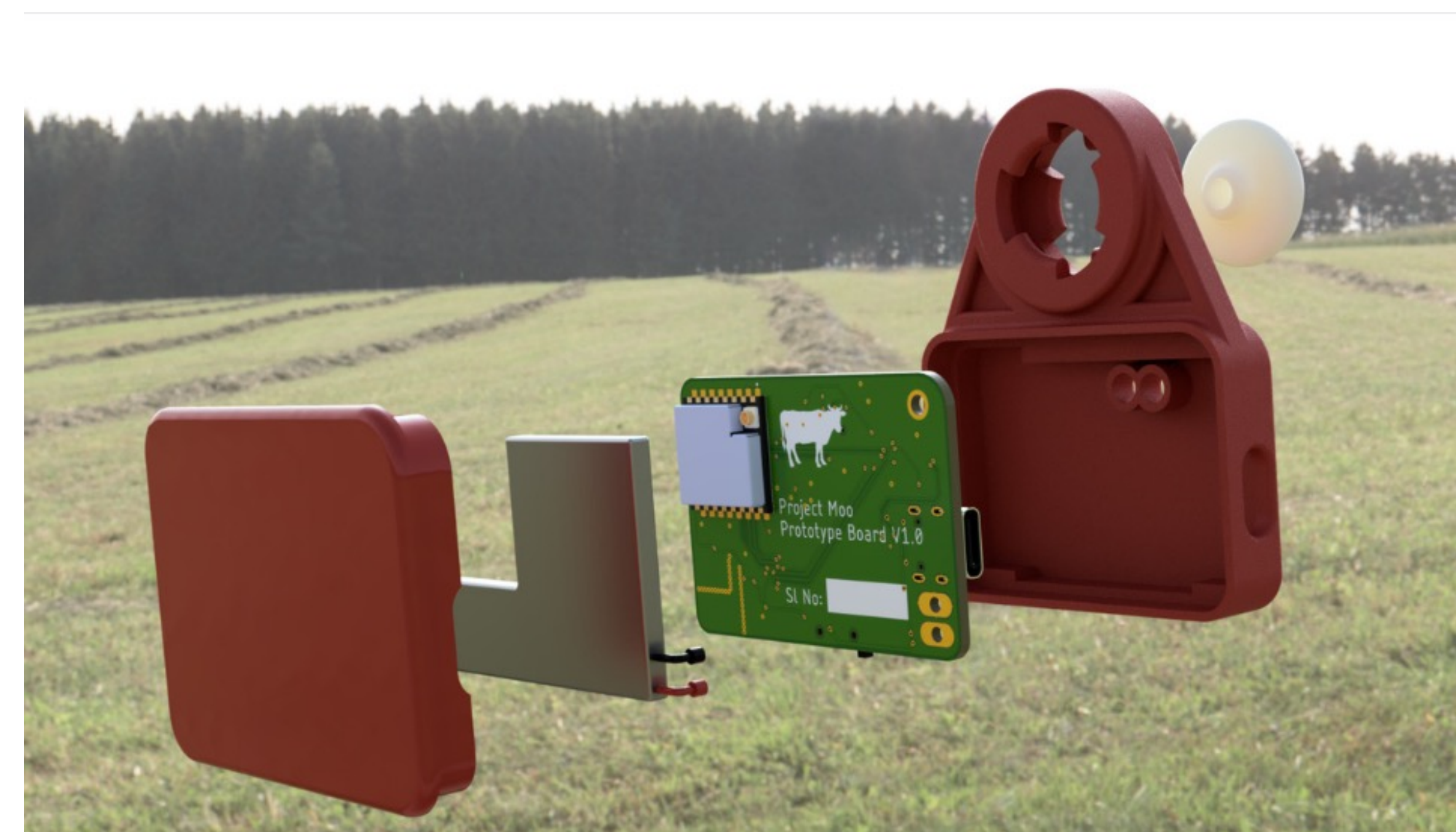
How Does Farm Plus Work?



Our Farm Plus Ear Tag has different sensors: Sound, Motion, Temperature to track cow's physiological parameters. The data is received by a LoRa Receiver and sent to the server for storage and analysis. The insights from the data will be available on our dashboard.

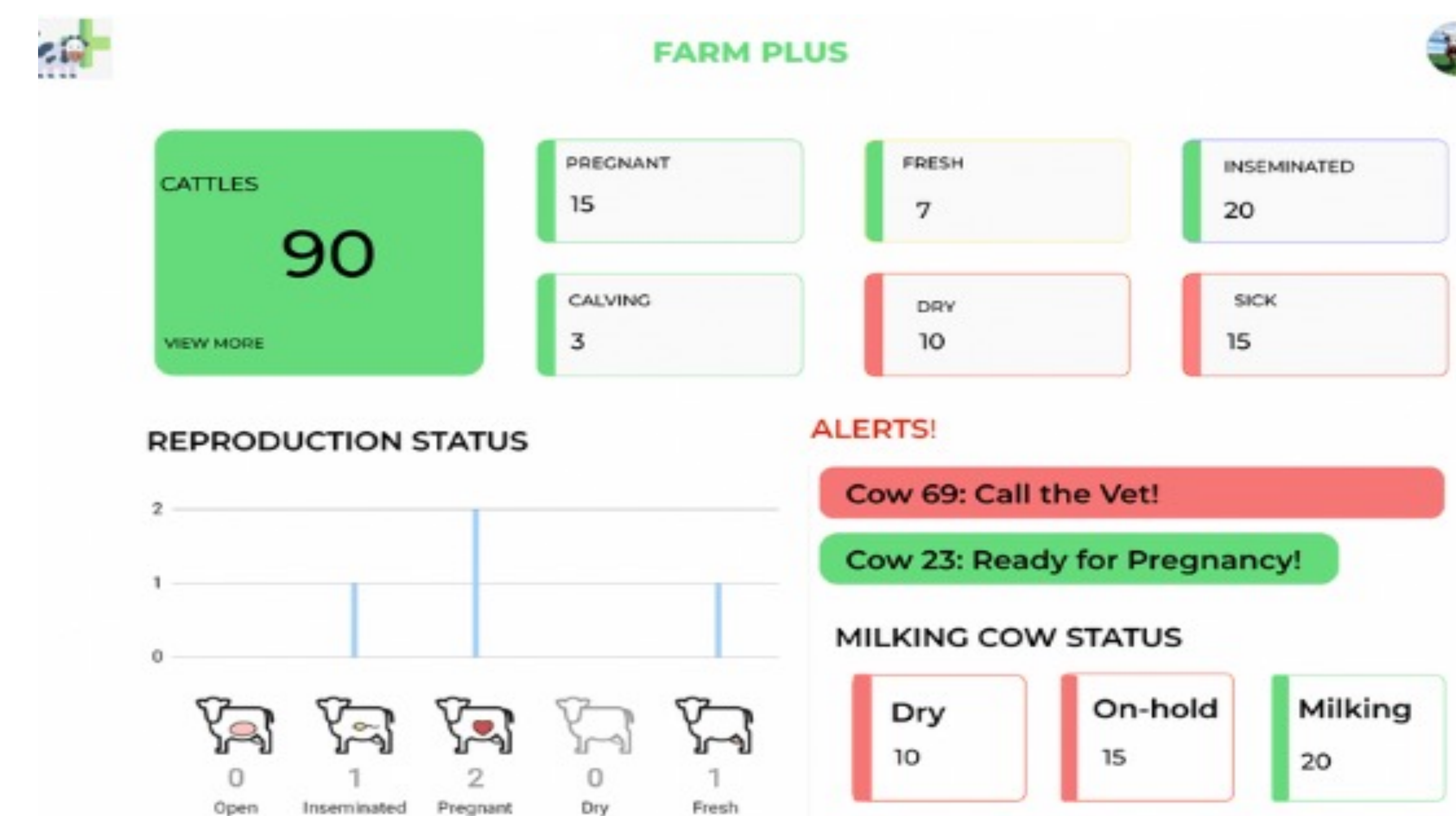
Our Technology

The product has two components - hardware and software: **The hardware component** will comprise sensors to monitor the temperature, humidity, motion in three directions and sound. These parameters are controlled using a proprietary System-on-a-chip unit (similar to an ESP 32 microcontroller) designed from the ground up to interface with the necessary sensors. The data from all the sensors will be transmitted wirelessly using either LoRa (Long range) wireless technology to a receiver substation on the farm that will upload the data regularly to a cloud based service such as Amazon AWS (Lambda). The database we will deploy is MongoDB. All onboard sensors and boards will be powered by a battery module of at least 1000 mAh that will be charged wirelessly using an induction charger (similar to wirelessly charging a phone).



A model of our final ear-tag technology with a battery and multiple sensors is shown above. The **software component** will include cloud-based services to store and process the data from each cow's device and host the dashboard and mobile application that the farmer can interact with to gain insights. In addition, we intend on developing algorithms that mine the collected physiological data to generate insights to predict the onset of disease, onset of ovulation and monitor the general wellness of the cow.

Our Dashboard



Conclusions

We have designed and developed a first level working prototype to continuously monitor the real-time physiological parameters of temperature, motion and sound of the cow. Our next steps include:

- Collect device data to construct a baseline dataset for healthy and diseased cows
- To build a machine learning algorithm to predict the onset of disease & ovulation period

Additional Questions?

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