



TEAM SHOCK'EM

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BACKGROUND

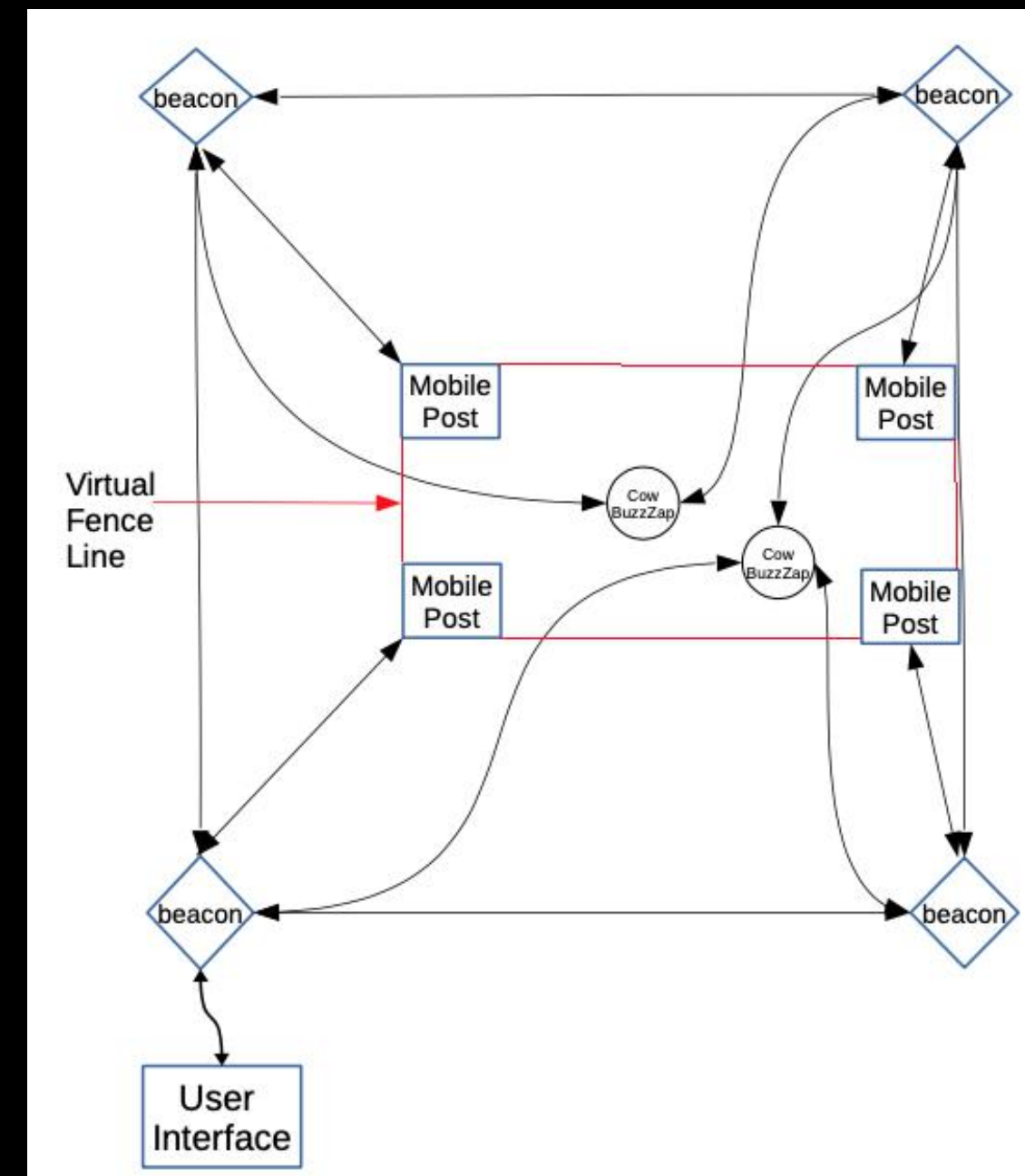
Currently, barbed wire fences are used as a border to restrict the movement of cattle. But the cost of barbed wire is very high and not easy to move. It also has the potential to injure animals, and requires regular maintenance. Ranchers cannot check the position of the cow at any time and must walk fence lines to determine if a cow has gotten out.

VALUE PROPOSITION

Current virtual fencing attempts rely on bulky, power-hungry, GPS-based systems with limited scalability for typical range livestock operations in Idaho and the West due to expense and connectivity requirements.

This project aims to reduce costs and power requirements by locating cows using local beacons and administering a shock or warning sound to the animal via a device in their ear tag.

SYSTEM DIAGRAM



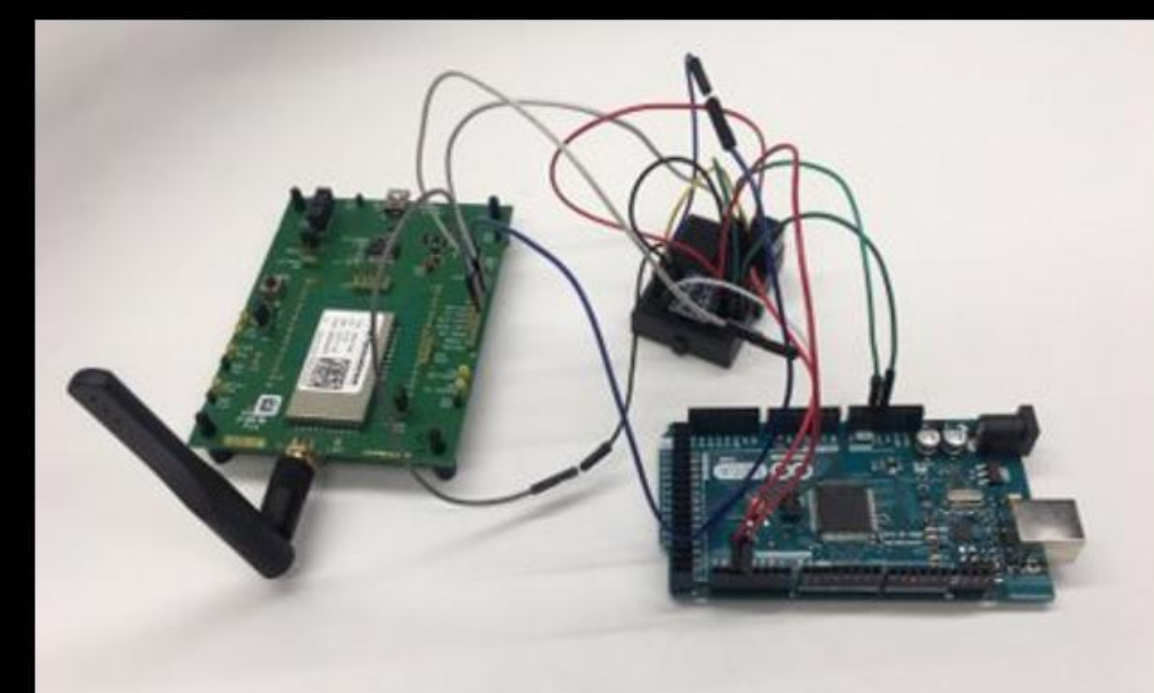
- Permanent beacons on perimeter of rangeland
- A host device on each permanent beacon connects a Nanotron device with an Arduino to control communications
- Mobile Fence posts to define the fenced region
- Cow devices to locate cows and shock or buzz them when needed

NANOTRON DEVICES

The system relies on the use of Nanotron devices.

These devices:

- Operate at a frequency of 2.4Ghz
- Calculate distance based on time of flight
- Operate at 3.3 V, 120mA and have low power options

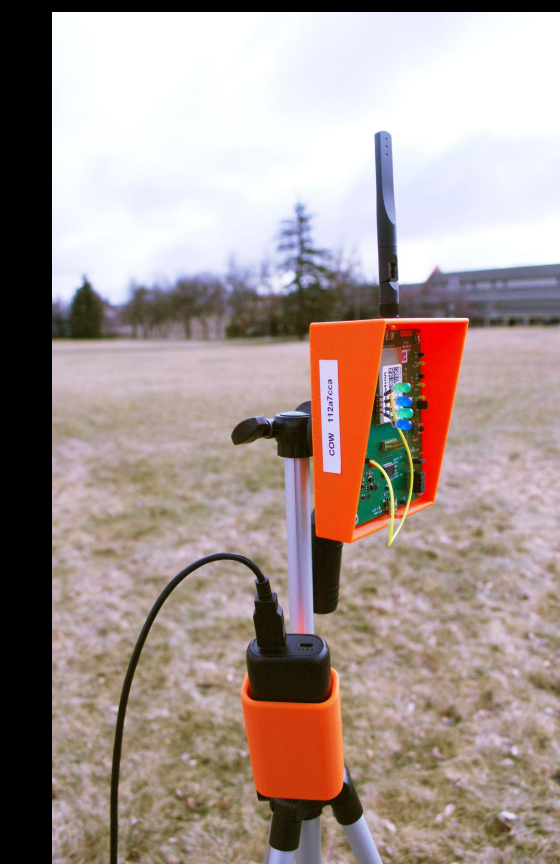


Nanotron-Arduino Host Connections

FIELD TEST RESULTS

Multiple field tests were conducted throughout the year. The Nanotron devices were spaced 70 meters apart with a single device modeled as a "cow" to see how accurately the system could locate. The most significant findings were:

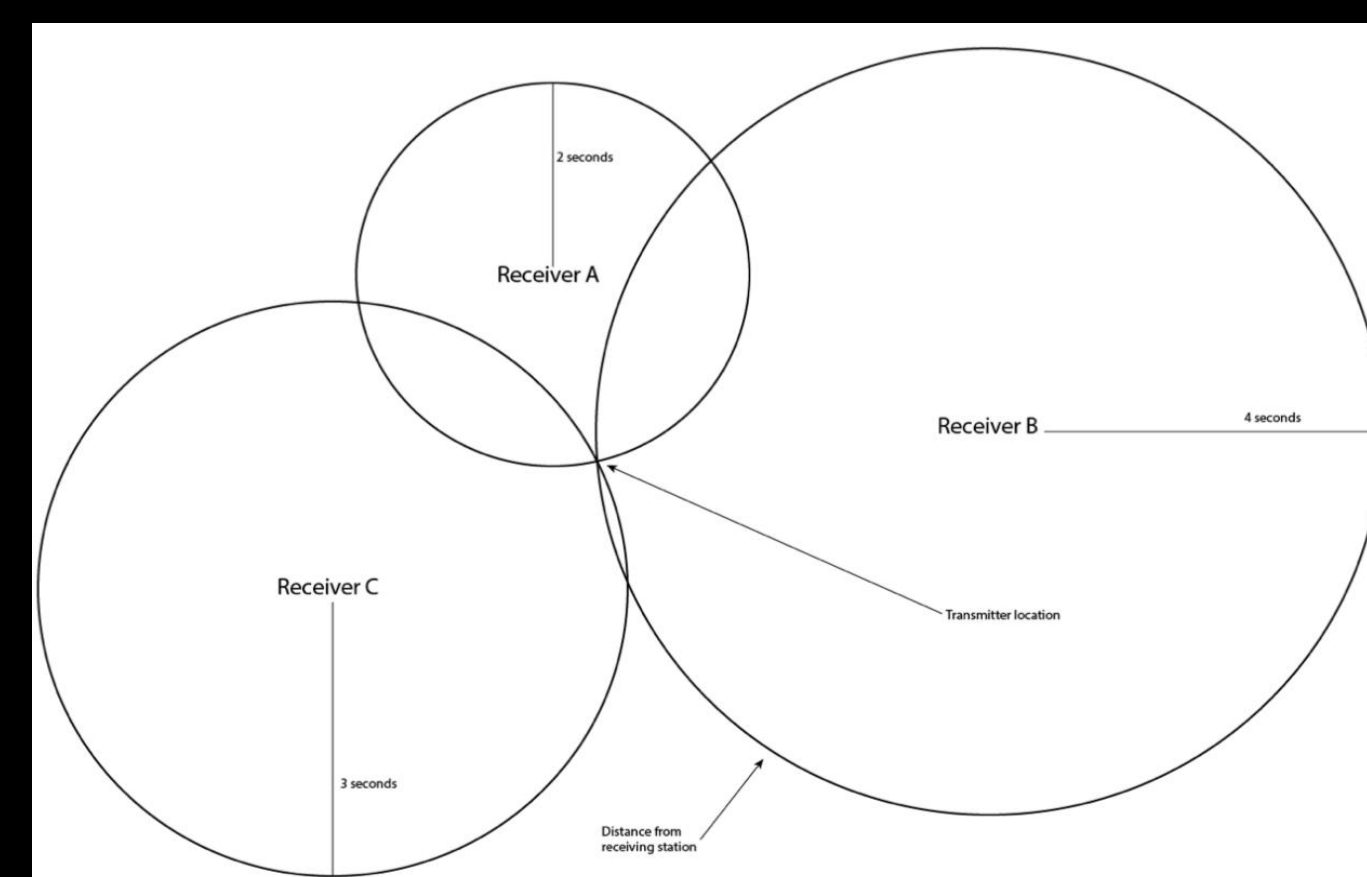
- The Nanotron devices must be well above ground level to send accurate signals
- Location detection is accurate within 1 meter



Devices used during field tests
Left: Permanent beacon Right: Mock "Cow"

TRILATERATION

Locating the cows is done by means of trilateration, similar to triangulation, except it accounts for error from the location of the Beacons and distances from point to point



Method of Trilateration

SHOCK CIRCUIT PCB

The shock circuit prototype shown, is designed to fit on the cow's ear tag. The device has a Nanotron module incorporated.



The device can send and receive signals via the Nanotron module and shock the cow or buzz the cow after receiving instructions from the permanent beacon devices.

DISCUSSION

During testing, there were consistent issues regarding signal strength. Various coax cables and antennas were tested with moderate success. Further investigation into signal strength is required. The shock circuit, in order to comply with animal welfare guidelines, must weigh less than 50 grams total. The current prototype weighs 76 grams. A reduction in component size, smaller footprint, and improved transformer design could allow for the targeted weight goal. The last field test performed had very encouraging results and was able to successfully locate a target within 1 meter.

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