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HARDWARE AND SOFTWARE DEVELOPMENT TOWARDS LAMENESS DETECTION OF CATTLE

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Abstract

A platform comprising four individual sections has been designed and built to determine a dairy cow's weight, hooves' position, the duration each hoof is on the section, and the stride length. The developed hardware and software is geared towards building a complete system to detect lameness in cattle, the ultimate aim of the project. Each section is an independent unit and consists of four ASB1000 shearbeam load cells, an AD7193 which is a 24-bit sigma-delta analogue-to-digital converter (ADC), and an ATmega328 microcontroller. The AD7193 ADC communicates with the microcontroller via the serial peripheral interface (SPI). Because each section contains its own microcontroller, an Arduino Mega 2560 has been used as the master microcontroller. This handles communication between the computer and all the sections. The master and sections communicate on a RS-485 half-duplex bus. The load cell values are transmitted from the master microcontroller to the computer via serial communication. The individual load cell value is then recorded and further processed where the data can be plotted, and the cow's average weight, stride length, hooves' position and duration can be calculated. The user also has the ability to render the data to a video file and to split cow data.

Laboratory testing was conducted to find the accuracy of the sections using a laser cut jig and a 20kg point load calibration weight. It was found that the X-position mean error is 1.0 ± 2.2mm, the Y-position mean error is 0.8± 1.8mm, and the total weight on the section has a maximum error of 0.4%. The mainframe to which the sections bolt to is 3000mm long and 540mm wide, while the individual sections measure 650mm long by 500mm wide. When the platform is assembled, the platform is 100mm high and has a walking surface width of 400mm. The platform sections are adjustable between the ranges of 700 ± 50mm to find the optimal stride length. The platform has been galvanized for protection against the elements. Experimental field testing was conducted at Massey Dairy Farm Number 1 where the signal signatures of 60 cows were recorded for further analysis. The recorded data was used as the basis for all the software tools that were developed; more field testing would be required to make the software more robust to different cow behaviours to see whether cow's weight, hoof position, duration of each hoof and stride length can be successfully and accurately calculated.

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