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IoT BASED LIVESTOCK PRECISION FEEDING SYSTEM USING MACHINE LEARNING

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GOAL OF THE STUDY

The proposed system records the biological clocks of animals according to their daily eating patterns and based on the data estimates determines the individually most appropriate feeding amount and feeding times for each animal.

METHODOLOGY OF THE INVESTIGATION

The proposed system comprises a hardware and software part, a feeding tank and a feeding bucket, a controller (Orange Pi), a L298N motor driver, a standard DC Motor, a 10Kg limited Load Cell, and an HX711 weight sensor amplifier.

Fig. 1. Functional diagram

Hardware: Orange Pi executes both the required control functions and provides an IoT connection for the system. It has a longer lifetime, advantageous both in terms of drawing current and price as compared to mini computers with similar architecture.

Software: The software serves two main functions: predict the required da based on the data collected and create useable information to control the feeding units. Python is used for programming the LSTM. The system uses Google Spreadsheet and Google Colaboratory and HTTP.

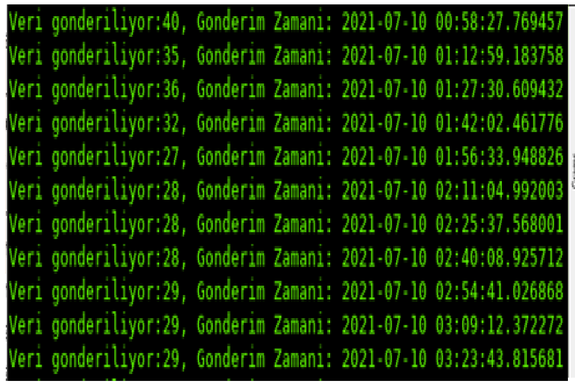

Fig. 2. Timestamped Data Samples

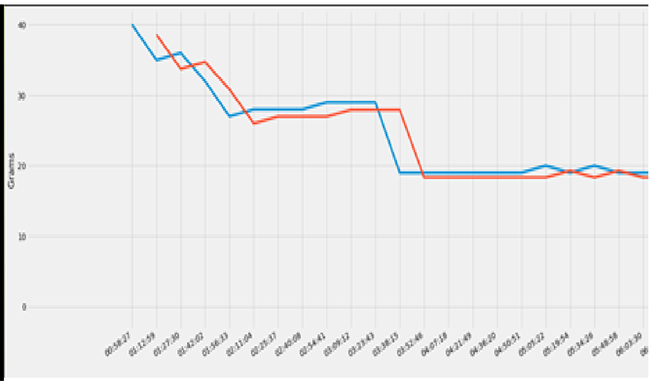

Fig.3 Original and estimated datasets

MAIN RESULTS FROM THE STUDY

An experimental prototype of the proposed system was tested in the veterinary facilities of Ege University where data was collected over several weeks. Furthermore a user interface for android was designed which allows the customer to track major system parameters. The UI is shown in Fig.4 below. A special purpose feeding tank and feeding bucket were designed.

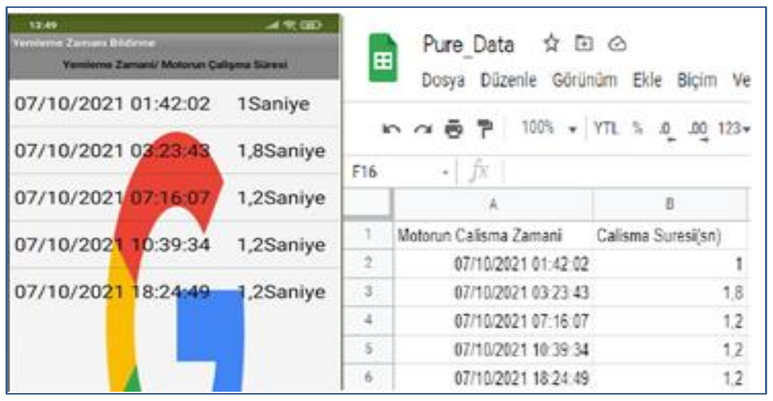

Fig. 4. User Interface snapshot

CONCLUSIONS

In this paper the prototype and operation of an IoT based precision feeding system using Machine Learning is presented. The system comprises a feeding tank, a feeding bucket, a control and communication module based on Orange Pi. It utilizes off the shelf software Google spreadsheets and Google Colaboratory. The prototype was designed and tested specifically for cows. However it can be also used, with very little modifications of the feeding device structure for other cattle as well. It is a low cost solution, which is easy to manufacture and adapt for different environmental settings. The system operates properly as required but a much longer operation (testing) period and more prototype devices should be used to really evaluate the long term outcomes and benefits of the method. Unfortunately these are out of the scope and duration of this project and will be included in further studies.