

Design and Implementation of the Monitoring and Warning of Dairy Cows Ruminant Regularity

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Abstract—With the continuous development of the breeding industry, the health inspection of dairy cows has become a very important part of the breeding industry in the large batch of dairy cattle. In many parts of our country, the method of human eye observation is still used to detect the ruminant status of dairy cows. The shortcoming of this method is time and force consuming. In order to solve these problems, a ruminant monitoring and warning system is designed composed of ruminant detection system, GPS device, WI-FI, main controller, alarm device and PC terminal to automatically detect the ruminant status of cows and locate the specific cows.

Keywords—Cow ruminant, onitoring and early warning Location, ressure sensor.

I. INTRODUCTION

With the vigorous development of precision modern aquaculture, aquaculture has occupied a large proportion of China's aquaculture, aquaculture shows intensive, large-scale aquaculture development trend. For large-scale farms, the outbreak of infectious diseases is the greatest harm to farmers. It is difficult to detect the changes of animal signs in advance by manual observation, so it is important to monitor the changes of animal signs in real time by sensors. At present, there is no mature ruminant detection device, mainly rely on artificial observation of ruminant phenomenon. However, for large-scale farms, manual monitoring of rumination per animal is too much work, and cannot achieve all-weather observation. For cattle, sheep and other ruminants, rumination has certain regularity. By monitoring the change of rumination frequency and time, we can find the changes of animal signs in time, and achieve the purpose of early detection, early prevention and early isolation. If the rumination of animals can be effectively detected, it will greatly reduce the investment of human and financial resources, which is one of the techniques that our breeding industry needs very much. There are a lot of ruminant research institutes in China, such as Shandong Normal University ruminant disease research center, Hebei Kaite ruminant research institute, it can be seen that the degree of concern is very high. If we can effectively detect the health of animals, China's aquaculture industry will go to a higher level, this technology is of great significance to China.

II. DAIRY COW RUMINANT REGULARITY MONITORING SYSTEM

A. The Hardware Design of Dairy Cow Ruminant Regularity Monitoring System.

This design includes two parts: hardware and software design. The module is divided into WI-FI module, rumination detection module, GPS module, main controller, alarm module, and PC terminal.

The block diagram of the system is shown in Figure 1. STM32C8T6 microcontroller is used to collect the data of ruminant sensor. Pressure sensor is used to collect the data of ruminant sensor. GPS positioning data is obtained to judge whether ruminant is abnormal or not. Then the buzzer is selected to alarm. WI-FI module is used to send ruminant data and positioning data to PC.

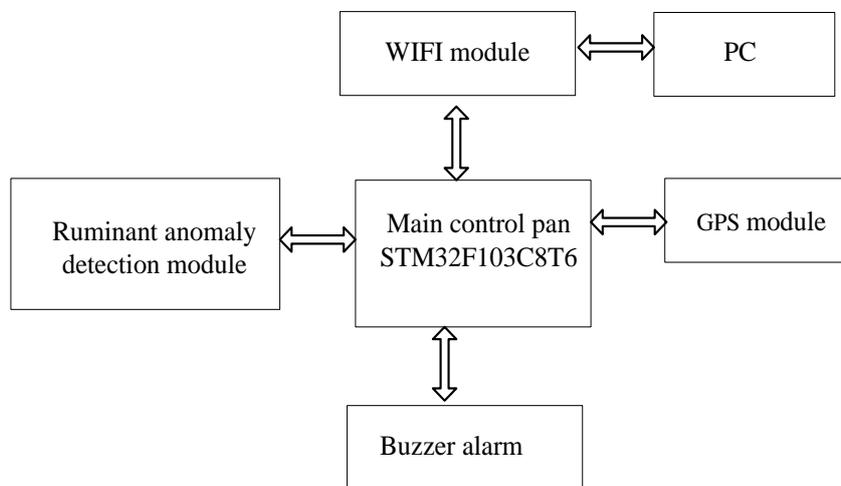


Figure 1. The system block diagram

STM32F103C8T6 is selected as the main control module. The internal processor is ARM 32-bit Cortex (-M3) CPU. It has the advantages of high processor efficiency, low cost and low energy consumption. It has been widely used in intelligent agriculture, intelligent detection, intelligent hardware industry and other industries.

The pressure sensor selected by ruminant sensor is based on the principle that the semiconductor piezoelectric impedance diffusive pressure sensor forms the semiconductor deformation pressure on the surface of the thin sheet, and the piezoelectric impedance effect is produced by the deformation of the thin sheet through the external force, so that the change of the impedance is converted into electrical signal.

ESP8266EX is a complete and self-contained WiFi network solution that can run independently or as a slave on another host MCU. ESP8266EX can be started directly from the external flash memory when it is loaded with applications and acts as the only corresponding processor in the device. The built in cache is conducive to improving the performance of the system and reducing memory requirements.

The alarm module is a buzzer. If the information obtained by the equipment is abnormal compared with the ordinary data, the equipment will operate the alarm buzzer to realize the alarm function and achieve the function of reminding.

B. The Software Design of Dairy Cow Ruminant Regularity Monitoring System.

After the equipment starts, the initialization operation of each parameter setting is completed first, and then the system carries out key scanning to determine whether the rumination is abnormal. And through the WI-FI module to transmit, display in the PC terminal, control the buzzer state. As shown in Figure 2. STM32 exchanges data with WIFI module through USART1 interface. After initialization, the program detects whether there is USART interrupt trigger. USART1 is the communication interface between SCM and STM32 processor, and USART2 is the communication interface between SCM and WIFI module. When USART1 receives the data, the MCU sends the data to the WIFI module through the USART2 interface. When USART2 receives the data, the MCU sends the data to the STM32 processor through the USART1 interface.

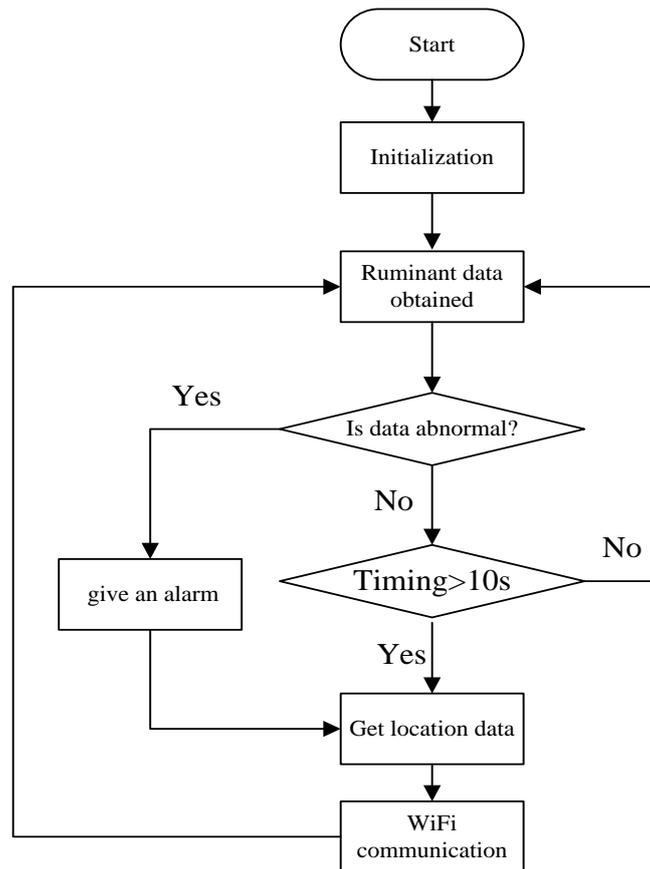


Figure 2. The flow chart

C. System Test Results.

When the collected data are not abnormal with ordinary data, it is higher than 4320 times per hour or 0. The buzzer alarm will not alarm, as shown in Figure 3 below.

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active:0 time/h, location:0 ,,0 ,
active:12240 time/h, location:10892 E, 3413 N
active:5040 time/h, location:10892 E, 3413 N
active:4320 time/h, location:10892 E, 3413 N
active:5760 time/h, location:10892 E, 3413 N
active:0 time/h, location:10892 E, 3413 N

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Figure 3. Normal data display

When the collected data is abnormal with the normal data, the blue indicator lights on once per hour below 4320 times, and the buzzer alarm will alarm, as shown in Figure 4 below.

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active:0 time/h, location:10892 E, 3413 N
active:0 time/h, location:10892 E, 3413 N
active:720 time/h, location:10892 E, 3413 N
active:720 time/h, location:10892 E, 3413 N
active:720 time/h, location:0 ,,0 ,

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Figure 4. Abnormal data display

III. SUMMARY

The rumination sensor collects rumination information of dairy cows and feeds it into the main controller. After comparing with the normal data of rumination stored in advance, it can judge whether the rumination of dairy cows is abnormal. If abnormal, alarm alarm, at the same time through WI-FI ruminant data and GPS positioning data sent to the PC side, when showing abnormal cow specific location information, to achieve early detection and early solution.

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