Automatic apiary care system

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Abstract **– an automatic control system for remote control and monitoring of bee life parameters in hives is developed. Based on the research of the main parameters of the life of bees in the hive, we have developed a scheme for managing and monitoring the weight of the hive, temperature and humidity, noise level, prevention of theft.**

Keywords **— monitoring; weight; temperature; hive; noise.**

I. INTRODUCTION

The trend of scientific and technological development in recent decades is the automation and application of information technology in traditional fields of human activity. One of the major areas of activity, where automation and informatization gives great economic benefits, is agriculture, namely honey production [1, 2]. More than 90% of honey in Ukraine is produced by households, the process of honey production in such farms is little automated, almost all production is done manually.

The aim of the work is to develop an automatic control system for remote control and monitoring of bee life parameters in hives.

II. EXPERIMENTAL LEARNIING

Based on the research of the main parameters of the life of bees in the hive, we have developed a scheme for managing and monitoring the following parameters:

1. The weight of the hive. Data on the mass of the hive allows you to control the filling of the hive with honey. Our system offers a single-point strain gauge.

2. Temperature and humidity -the temperature range measured must be between -20° C and 40° C. We proposed the use of a two-parameter temperature and humidity sensor.

The temperature will be regulated by a fan and a heater. The system will maintain a constant temperature under different conditions: in spring and summer the temperature of the hive should be 25...27° C. In September, the temperature should be 20° C. When there is no brood. it is reduced to 9...12° C. In October, its norm is 8…9° C. At the beginning of winter the temperature should be the same. Its reduction inhibits the activity of bees.

3. Noise level. Noise level measurement is implemented using a sound sensor. A healthy family was taken as a standard and noise levels were taken under normal conditions, in a state of rest, restlessness, or swarming, and a "true" value was established according to which the noise norm threshold was established.

4. Prevention of theft. To provide an alarm for the opening of the hive, the alarm is implemented when closing/opening the lid using the opening sensor.

Management, processing and output of data will perform the ESP 8266 microcontroller with built-in Wi-fi module, the received data is collected and displayed on the web server, for remote monitoring of parameters (fig. 1).

Power provided by an external battery 12 V. Sensors: DHT-11 digital temperature and humidity sensor; microphone with sound amplifier LM386 and comparator LM393 with analog output, step-down voltage converter on the chip XL4015 with regulation of output voltage and current limitation and maximum output current up to 5A, the converter has protection against short circuit of the load when triggered. 2pcs 5V 1-channel low level relay modules; superminiature reed switch 2-pin.

Executing mechanism: film heater for beehives 12V with a power of 10 W; cooler with a nominal voltage of 12V.

The developed algorithm of system functioning (fig. 2) provides measurement of temperature, humidity, weight, noise level, check of a signal from a reed switch and sending to the site / server. Accordingly, is checked for compliance with the condition: the temperature is in the range of set values or not, respectively, if the temperature is not within, the fan or heater will be turned on. If the temperature is within the set range, the heater / fan is switched off.

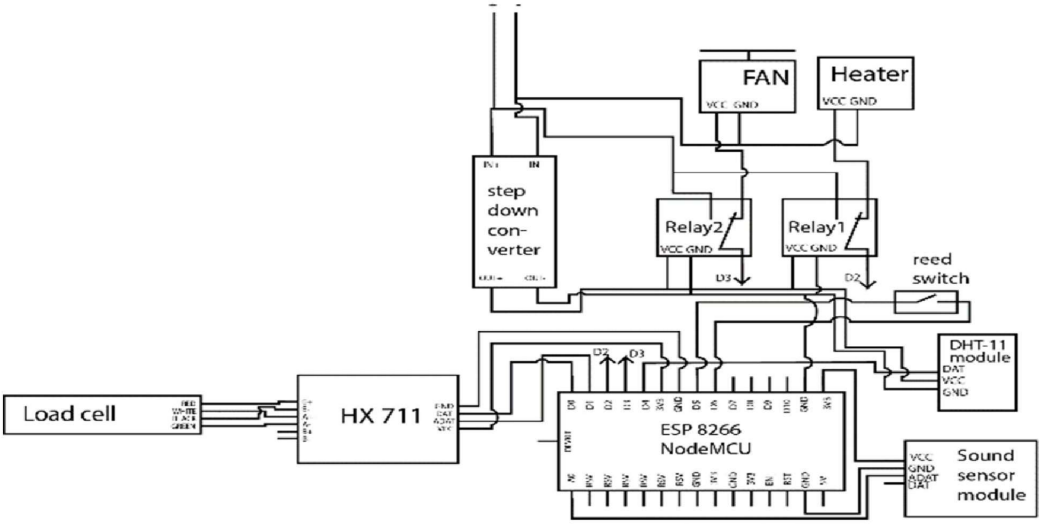

Figure. 1. Block diagram of the automatic system of care of a beehive

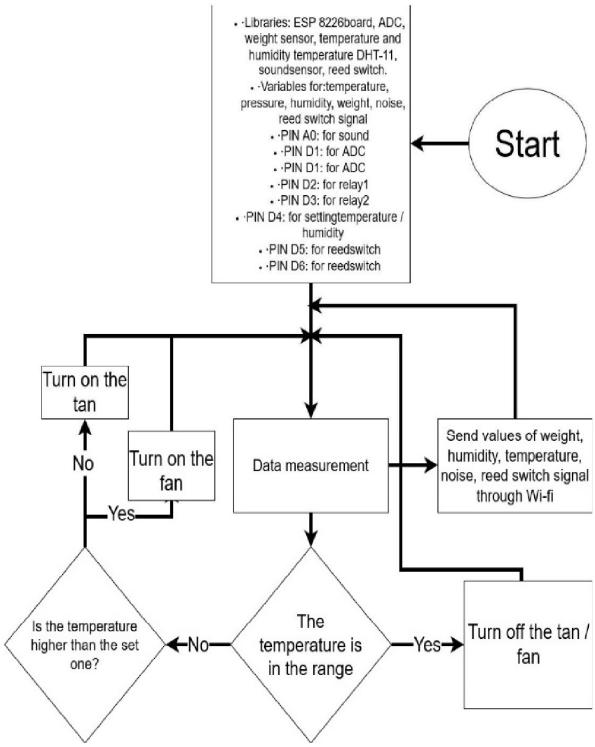

Figure. 2. Algorithm of functioning of the automatic system of care of a beehive

Figure 3 shows a mounted model of the prototype of the developed system

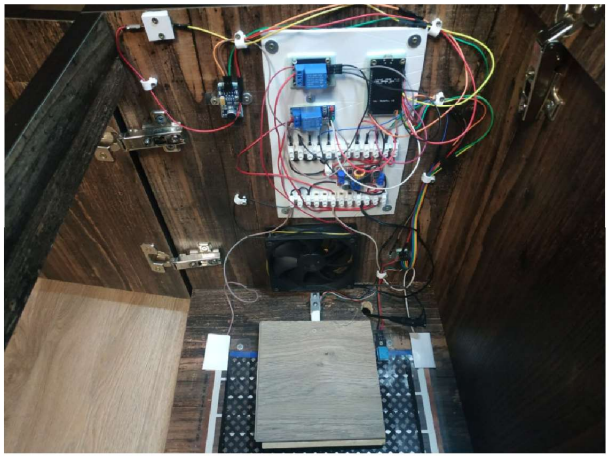

Figure. 3. The experimental model of the developed system

III. Conclusions

An automated system for remote care of the hive has been developed, which allows to remotely control and maintain the state of the basic parameters of bee activity. Among the further improvements can be noted the transition to autonomous power supply through the use of solar energy (solar panel, battery, charge controller)

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