THE IMPLEMENTATION OF AN AUTOMATED SYSTEM OF MONITORING OF THE STEAM TEMPERTURES AT THE FORMATION OF COMPOUND FEED GRANULES

CRISTIAN VASILE
Faculty of Agronomy, University of Craiova, Romania

Keywords: informatic program, automated monitoring, temperature, granules, combined feed

ABSTRACT

The zootehnic farms provide an important part from the necessary of food for population and the increase of productivity can be assured through widespread use of compound feed in the nutrition of animals, which can ensuring the optimal necessary of nutritive substances. Therefore, the factories of combined feed increased and diversified the production, and this fact involved the need to be equipped with modern installations of work, with a high level of mechanization, automatization and computerization.

In this article is presented the way of implementation of an informatic program which allows automatic monitorization of the steam jet temperatures that allows the sterilization of the final mixture of combined feed and helps at the same time to compact it in the moment of passing through the molds of working installations. In this way the final product of combined feed can be obtained in different forms of granules and with different weights, depending on the species and age of animals fed.

INTRODUCTION

The upward evolution of the society and at the same time the demographic increase at the world level determined a diversification of consumer needs and a significant increase of the necessity of food for people. This requirements can only be solved by the intensive growth of different species of animals in specialized zootechnical farms. For the attainment of a high productivity in this type of farms is a need an optimal nutrition of the animals depending on their species and ages, by the use of different recipes of compound feed.[5, 7]

The technological flow of the production of combined fodder is a complex process which involves the crossing of several steps: transporting the raw materials, namely the ingredients that are part of the recipe, dosing the ingredients according to the recipe, mixing, homogenizing the granules and finally packaging the finished product.[6, 7]

For growth of labor productivity in the combined fodders factories it is followed the increase of the automatization degree of the activities from the technological flow, so as to ensure quick and precise measurement of working parameters necessary to obtain the desired recipe of mixed fodder.

The temperature of the steam is one of the key elements in the production process of combined fodders, because the sterilization of combined fodder is realized with its help, respectively its binding, operation called granulation. And from this point of view it is necessary to study the automation system of the installation, because based on the values read, it acts on the steam generator, meaning to increase or decrease the temperature of the work agent.[1, 3, 4]

Therefore, to the combined fodders production installation, on the steam generator, was installed a special thermometer which indicates the steam temperature, which is then connected through sensors to the automation integrated system designed at the combined fodders factory where the analyses and measurements were made.

MATERIAL AND METHOD

The steam generator of the processing instalation (figure 1) is of German origin, CERTUSS JUNIOR, having as primary fuel the liquefied petroleum gas.

Figure 1: The steam boiler type Certuss Junior used in the processing instalation

For a more accurate verification regarding the functionality of the automated steam temperature acquisition system, in this experiment were used two different temperature sensors which acquires values independently of each other, meaning it work on two independent data acquisition channels. Finally is made the arithmetical mean of the values of these data channels for finding the value of the steam temperature at a certain moment.

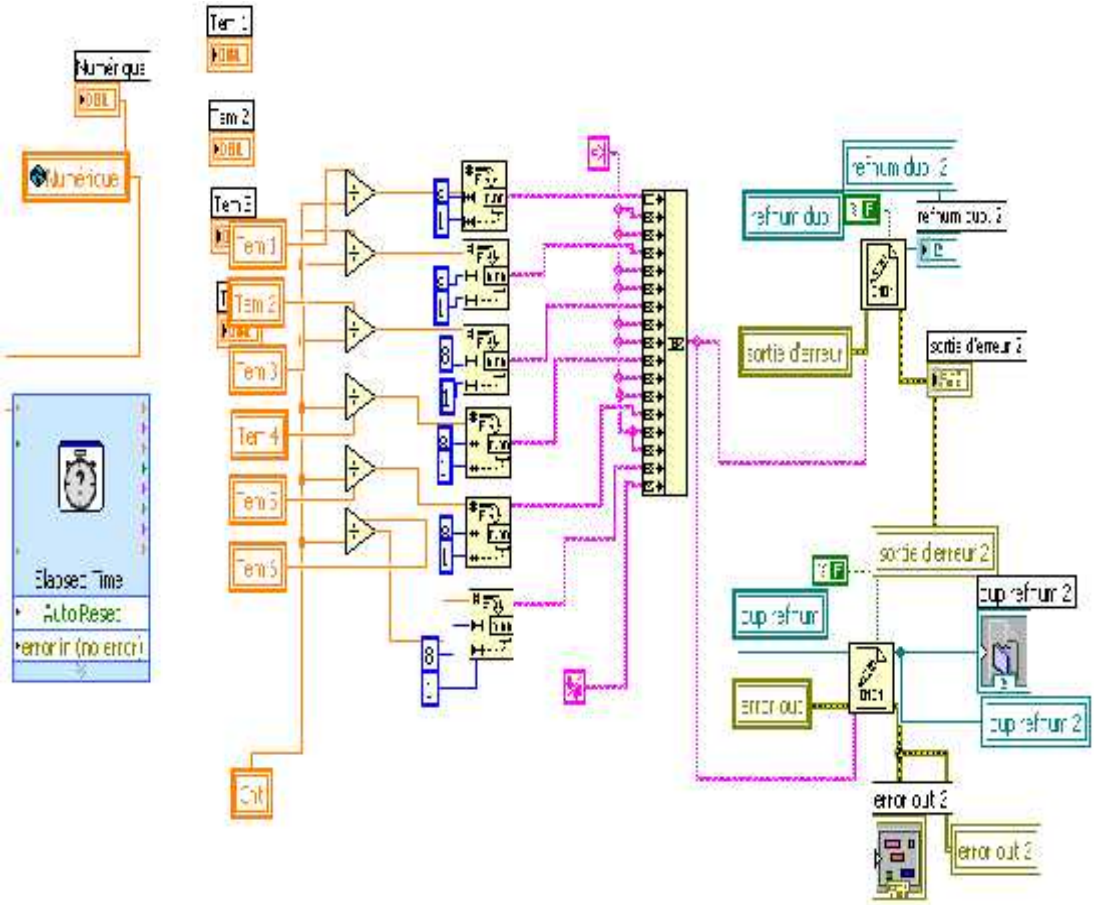

Figure 2: The program in Labview of the computer application

The automatic system of steam temperature acquisition is controlled by a specialized program of data acquisition, which was designed and accomplished on the Labview programming platform, version 8.5, by National Instruments [1, 2]. Unlike other programming backgrounds, this one doesn't have command lines, but instead, it uses a graphic display which allows the operator to choose a certain virtual device of work, that means a some electronic component of the electric scheme, depending on purpose.

For the experimental research performed to the combined fodders production installation for Broiler chicken according to their stage of development, a special computer program was implemented, which allows the measurement and the automated control of the steam temperatures at the mould used to obtain granules.

The computer programme has an interface very easy to handle by the users, and this corresponds to a programme created in Labview, with the aid of which was designed the flowchart and was built the system used to perform the measurements for the temperatures of steam monitored through converters type PIXSYS ATR 243 ABC.[1, 2, 4]

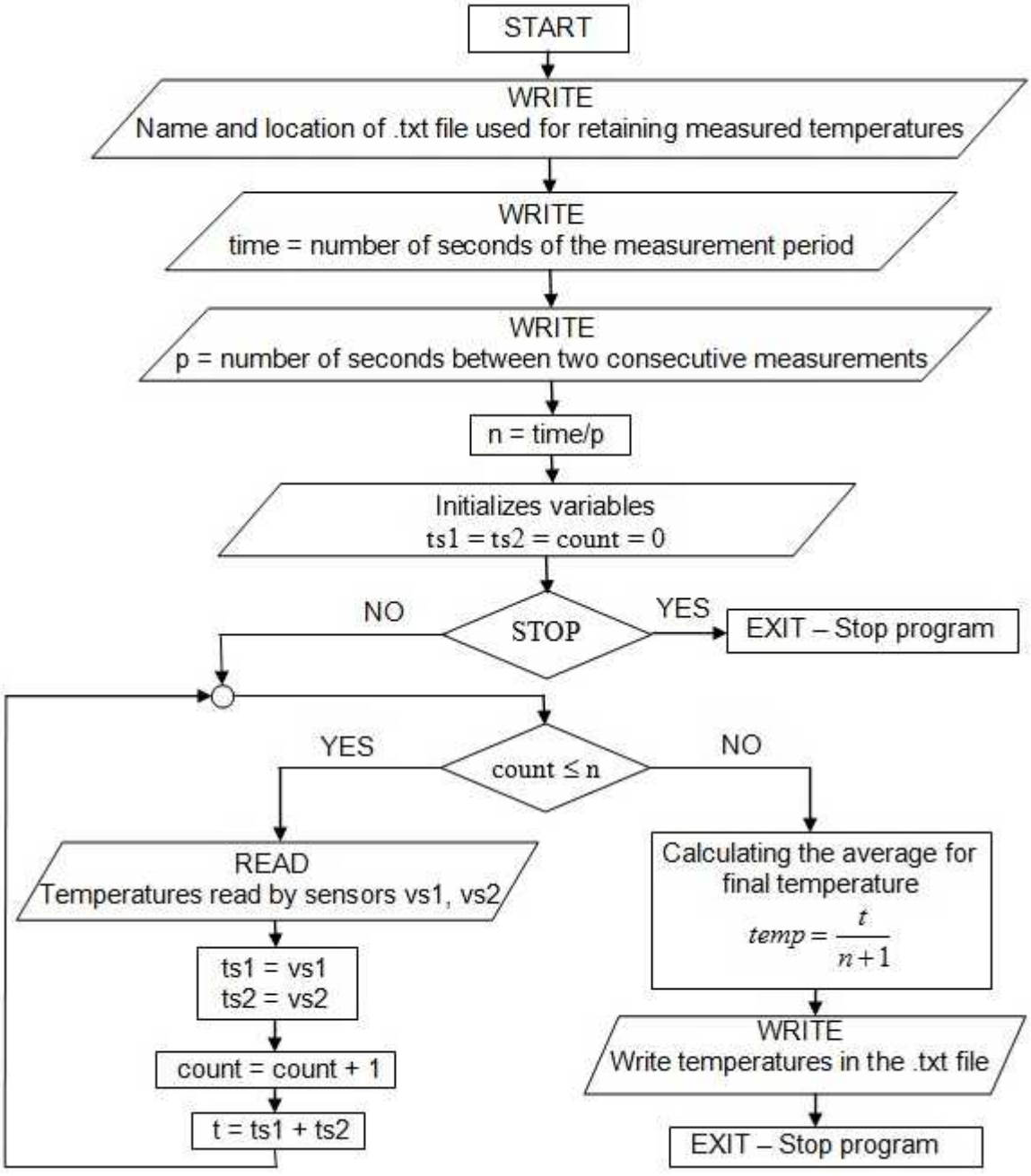

Figure 3: Flowchart of the temperature monitoring application

Figure 2 illustrates the work interface programme, as was designed in the Labview environment. It is noted that the programming in Labview mode uses blocks and interactive virtual electronic devices linked together. The flowchart of the application, on which the automatic temperature monitoring is based, is presented in figure 3.

The monitoring steam temperature interface starts automatically after the conditions imposed by the main menu of the application have been fulfilled: should indicate the name of the text data file which contains the values of the measured temperatures and the location for saving of this data file on the hard disk of the computer and must specify a time interval in which the measures are being performed. In this way, the software programme will enable the collection of some successive temperature values in this time interval through the installed sensors and Pixsys ATR 243 ABC converters, after which the values of the read temperatures are averaged and thus the final value of the steam temperature at the entrance to the granulating mould will be obtained.

THE OBTAINED RESULTS

A critical point of the technological flow of the production of the compound feed that must be carefully monitorized in terms of automation system of the work installation is the temperature of the steam that enters in the mould, where practically takes place the forming of the granules of compound feed.

The steam action is double: on the one hand, the steam sterilizes the compound fodder granules, because of its high temperature, and on the other hand it realizes the connection of elements which form the granules.

To observe the behavior and the measurement precision of the temperatures in this point of the integrated automation system, it must be realized the comparison of steam temperatures values obtained through the two methods of measurement:

I) by classical variant of temperature measurement with the help of a specialized thermometer;

II) by using an automated system answering temperature values by means of sensors and then processing them by means of converters type Pixsys ATR 243 ABC and a computer program.

In this study were carried out measurements during the technological flow of producing three types of compound feed: for broiler in phase "starter" (BS), for broiler in phase "growth" (BG) and for broilers in phase "completion" (BF).

Steam temperatures at the entry into the mould were acquired simultaneously by both methods described, for each type of combined fodder in part, during their obtaining.

Table 1 presents the values of temperatures read on the special thermometer attached at the steam boiler of the installation for the production of compound feed.

Table 1

The values of temperatures read on the thermometer attached at the steam boiler

The measurement time	T_{BS} [°C]	T_{BG} [°C]	T_{BF} [°C]
t_1	167	152	154
t_2	166	151,5	153
t_3	165,5	150	153
t_4	165	150,5	152
t_5	166,5	151	153
The final mean value	166	151	153

When activating the software was established the measurement time at 2 minutes, and the interval between two successive measurements is 30 seconds, which means in this time were conducted five data collections for steam temperature using automated

system designed for this purpose. In Table 2 are shown the temperatures measured by the sensors of the automated electronic system of monitoring the temperature of the steam.

Table 2

Steam temperature values collected by sensors

The measurement time	T_{BS} [°C]		T_{BG} [°C]		T_{BF} [°C]	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
t_1	163	162,6	152	151,5	148,2	148,3
t_2	162,9	163	151	151,7	148	148,2
t_3	162	161,3	149,3	150,2	147,3	148,1
t_4	160,7	161	149,2	150,1	146,1	147,2
t_5	160,8	160,7	148,7	149,3	145,2	145,4
The final mean value	161,8		150,3		147,2	

Thus, in figure 4 are presented the values of temperatures of steam which have been measured with the special thermometer attached to the boiler of the work installation.

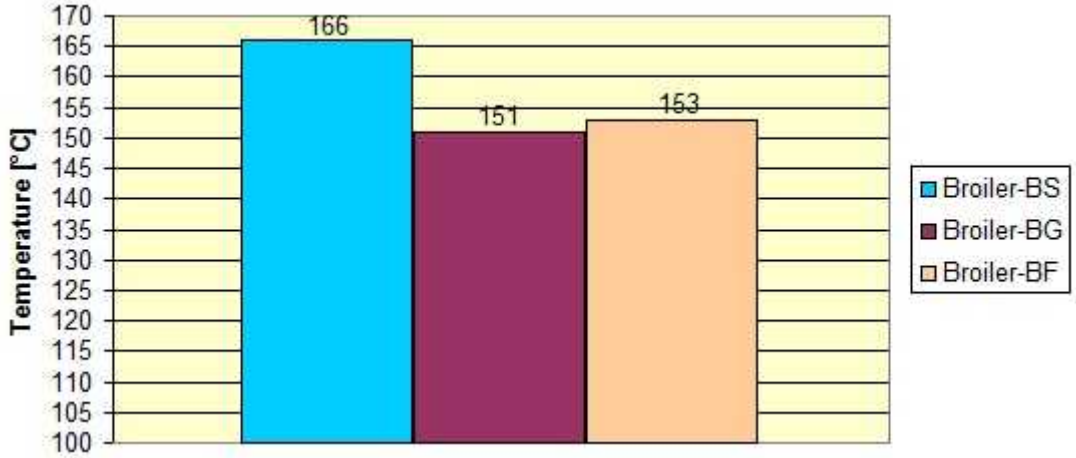

Figure 4: Steam temperatures from mould measured with an attached thermometer

Also in figure 5 are presented the temperatures of steam at the entry into the mould, which has been registered by automation system integrated in the working installation.

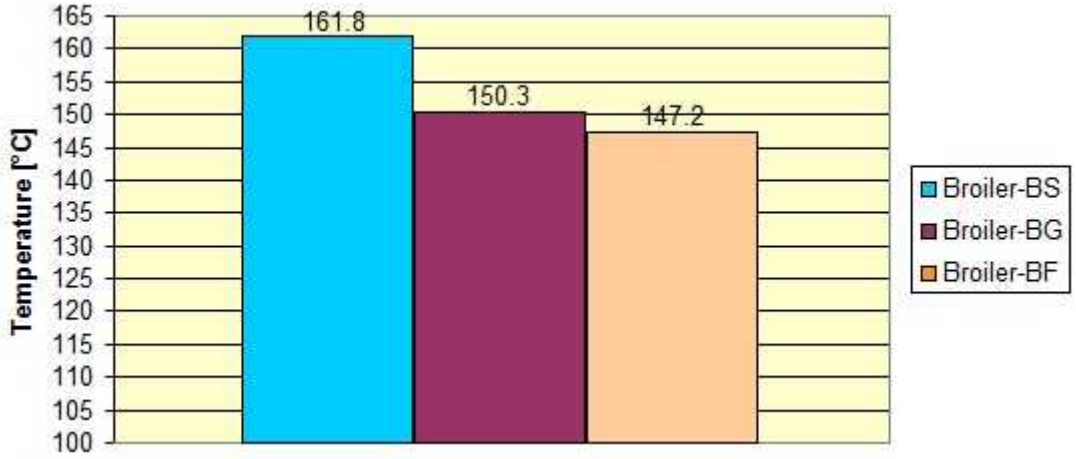

Figure 5: Steam temperatures from mould measured by the automation system integrated (ASI)

By analyzing values of the steam temperatures of the input into the granulated mould obtained by the two methods of measurement it can be observed that there are not significant differences, which attest the fact that the informatic monitoring automatized

program of these temperatures has been correctly designed and it work optimally to drive the technological flow for the production of various recipes of combined fodders.

CONCLUSIONS

It should be noted that at this point of technological flow, occurs effective the formation of the granules of combined fodder, which makes this area of work to be, in fact, the most important in the obtaining process of combined fodder.

The values of the steam temperatures measured by the integrated system of automation organizes and drive the production process, which means that a value measured incorrectly may alter the finite product.

The appearance of temperature differences should not be neglected, because these values command the automated system of operation and control of the installations of work and can determine modifications at the recipe of combined fooder. But at the same time the automated system has implemented and a certain tolerance in the management of the measured values, because it must be taken into account that any temperature variation presents measurement errors, which vary according to the components of the system. For example, in view of the nature of the process to be analyzed may appear small deposits of materials on the surface of the sensors used for data recording, what default lead to measurement errors.

In this case, all final products which have been obtained during the measurements have come out in accordance with the requirements of the beneficiaries from the point of view of quality, which strengthens the idea that the automation system implemented is operational at the prescribed parameters and that it enables the correct evolution of the technologic flow in the compound feed factory where was made the research.

BIBLIOGRAPHY

1. **Bond, T.C.,** Covert D.S., Kramlich J.C., Larson T.V., Charlson R.J., 2002 – *Primary particle emissions from residential coal burning: Optical properties and size distributions*, Journal of Geophysical Research: Atmospheres, vol. 107, no. D21, pag. 1-14.
2. **Brîndușa, P.,** Iliescu C., Faur D., 2006 – *Mesures electriques et transducteurs*, Matrix Rom Publishing House, Romania, pag. 36-44.
3. **Gaceu, L.,** 2006 – *Tehnici moderne de uscare a cerealelor si plantelor tehnice*, Editura Universitatii “Transilvania” Brasov, pag. 97-102.
4. **Ionel, I.**, ş. a., 1994 – *Măsurarea emisiilor din gazele de ardere cu ajutorul senzorilor electrolitici*, The National Conference of Thermodynamics, Vol. I, Timişoara, pag. 231-235.
5. **Ţucu, D.**, 2007 – *Sisteme tehnologice integrate pentru morărit şi panificaţie*, Editura Orizonturi Universitare, Timişoara, pag. 71-82.
6. **Vasile, C.,** Simionescu S.M., Glodeanu M., Alexandru T., 2015 – *Experimental research regarding technological flow automation in a combined fodder factories*, SGEM2015 Conference Proceedings, ISBN 978-619-7105-42-1 / ISSN 1314-2704, Book 6, Vol. 1, pag. 427-441.
7. **Vasile, C.,** 2015 – *The analytical and experimental modeling of functioning of automated installations from CFF*, Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series, Vol. XLV, no. 2, ISSN: 1841-8317, pp. 241-246.