MONITORING SYSTEM FOR SPARK PLUGS PRODUCTION

Scientific reas. dipl. eng.: Cigmăian Dan, Pătru Mircea, Molnar Petru, Vejia Cornel, Alban Doinel, Marius Şerban

S.C. Software ITC S.A. Cluj

Dipl. eng. Tolan Gheorghe, Banciu Florin

S.C. *SINTEROM S.A. Cluj*

Abstract

The presented system performs real time monitoring and recording for intermediate and finit product from spark plug workshop. It includes hardware and software components as: distributed acquisition network of primary data, controlled by a process microcontroller, sending – receiving primary data soft modules, application system software, implemented in a dedicated PC for process monitoring, generating, recording and using of data bases. The system and this paper was achieved in cooperation and with permision of S.C.SINTEROM S.A. Cluj.

Keywords: monitoring system, microcontroller, data aquisition

1. The purpose of system

The main tehnological characteristics of spark plug production are: the diversity of finite products; many technological intermediate phases for subansamblies components; the convergence in finit product of intermediates products from differend workshops; the possibility of various rhythms of production phases.

For modernizing of mentioned technological line was proposed and achieved an informatical system for full production monitoring, from elementary components stages or intermediate ensembles phases to finit product.This system offer to workshop foreman, and to supervising factory personnel of the plant, product data reporting for improvement the technological flow through:

- correct planning of all workshop production;
- avoiding technological blockages;
- monitoring and decreasing of intermediate stocks;
- analitical presentation of intermediate and finit production;
- achieved production by workers, teams and work schifts;
- daily and monthly production evolution.

2. The hardware and functional structure of system

Fig. 1 present the block scheme of the informatical system. The primary data acquisition of pieces production number is performed by a dedicated acquisition network, mastered by a microcontroller (Data Logger- RTU).

The detecting of processed pieces from working posts is performed by proximity sensors, which are sending electrical pulses, counted by a master microcontroller. One post have a special counting, performed by weighting with a dedicated electronic balance, projected for this purpose. Counting informations are memorized by microcontroller in records containing post number, time and the number of processed pieces.

Production data, memorized in microcontroller, are sent by a serial interface RS-485 to a system PC, disposed at the foreman workshop post. The communication are performed by connection programs, running in microcontroller and PC.

Data acquisition at microcontroller from posts transducers is performed in real time. The sending and voiding of data to system PC is performed at every starting of computer, for precedents days, and in real time, for current product data .

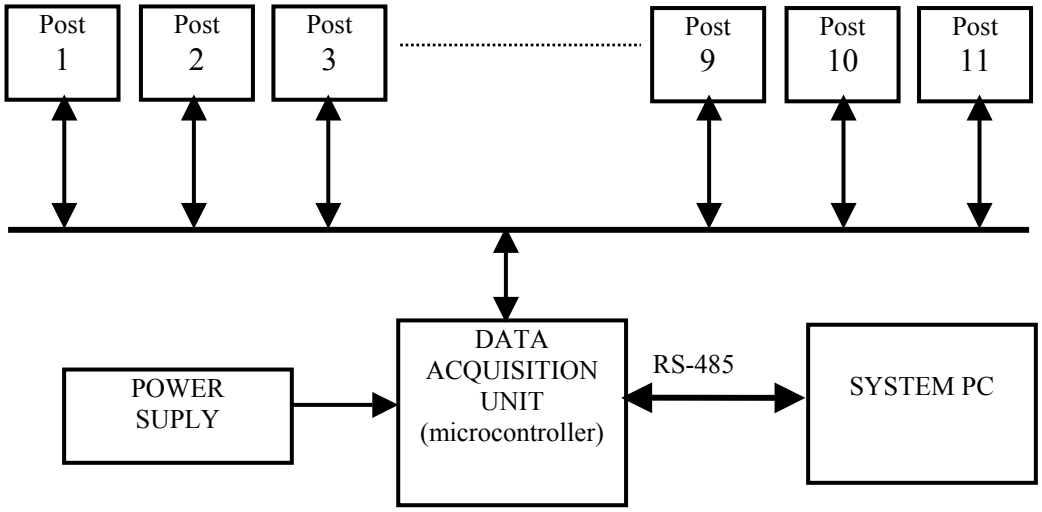

Fig. 1. The block scheme of monitorning system of spark plugs production.

3. The system data flow; the function of acquisition and aplication software

The implemented system software has two basical components:

- **The primary acquisition data software,** regarding the counting of product pieces, implemented in datalogger RTU and PC;
- **The application software**, for product monitoring, data bases generating and data reporting at workshop level and at factory supervisory level, implemented in system dedicated PC and in local network stations.

The two components are running simultaneously and autonomously. The microcontroller's (datalogger RTU) continuos work insure continuity of the acquisition of data.

The application PC software, can be started at operator request. Data updating is based on contents stored in a nonvolatile memory of the RTU microcontroller and a PC communication program.

The link between the two components is achieved through a primary data base, created by the acquisition software for the application software.

The structure and main modules components of spark plug monitoring software system is presented in fig. 2. The data flow processed by the program modules is: acquisition network hardware – datalogger acquisition program – datalogger nonvolatile memory –communication program to PC – primary data bases PC –generating module of daily and monthly data bases – operator interfacing modules - system operator.

A branch in data flow is the connection of data bases with local computer network of the plant. This synthetical production data in workshop can be accessed at the local stations by the management staff of the plant.

System information has three main components:

- input information, suplied by:
  - automatical counting and acquisition network for primary data from working posts;
  - PC operator (foreman or qualality inspector);
- memorized information in files form; it's generation, computing and using is performed by the program components modules;
- output information, delivered to system users through:
  - reporting windows of production situation;
  - diagrams of production evolution;
  - data base files.

In the following is presented the general function of application software (fig. 2).

Data from transducers are acquisitioned by RTU datalogger. The number of pieces processed at an working post is memorized periodically at every minute. This is performed for 10 working posts, equipped with proximity sensors, through counting. From the weighing post is aquisitioned the integral weigh (box and pieces). The RTU acquisition program record these data in local memory . The aquisition of data in RTU controller is performed automaticaly and continuously due to uninterruptibile of his function.

An recieving program at system computer ensure periodicaly the taking over of data from RTU and stocking them in primary daily product files. An application program task extract this data and process it, ordering it by working posts, pieces and positions, accumulated in a current product file from the starting of the working schift. Another program task ensure recording of final production by direct typing at operator console.

For every two working schifts there is an allocation file of workers and working teams at the working posts, and also a allocation of pieces for every post and positon of a dedicated switch. This files are updated and validated daily by the foreman of the workshop at the begining of the every working schift.

For updating of the allocation files is used information from special files of personnel and technological lines for every type of product. These files are updated by the workshop foreman.

An calibration module program perform the calibration for assembled parts, counted by weghting and records the calibration information in a calibration file.

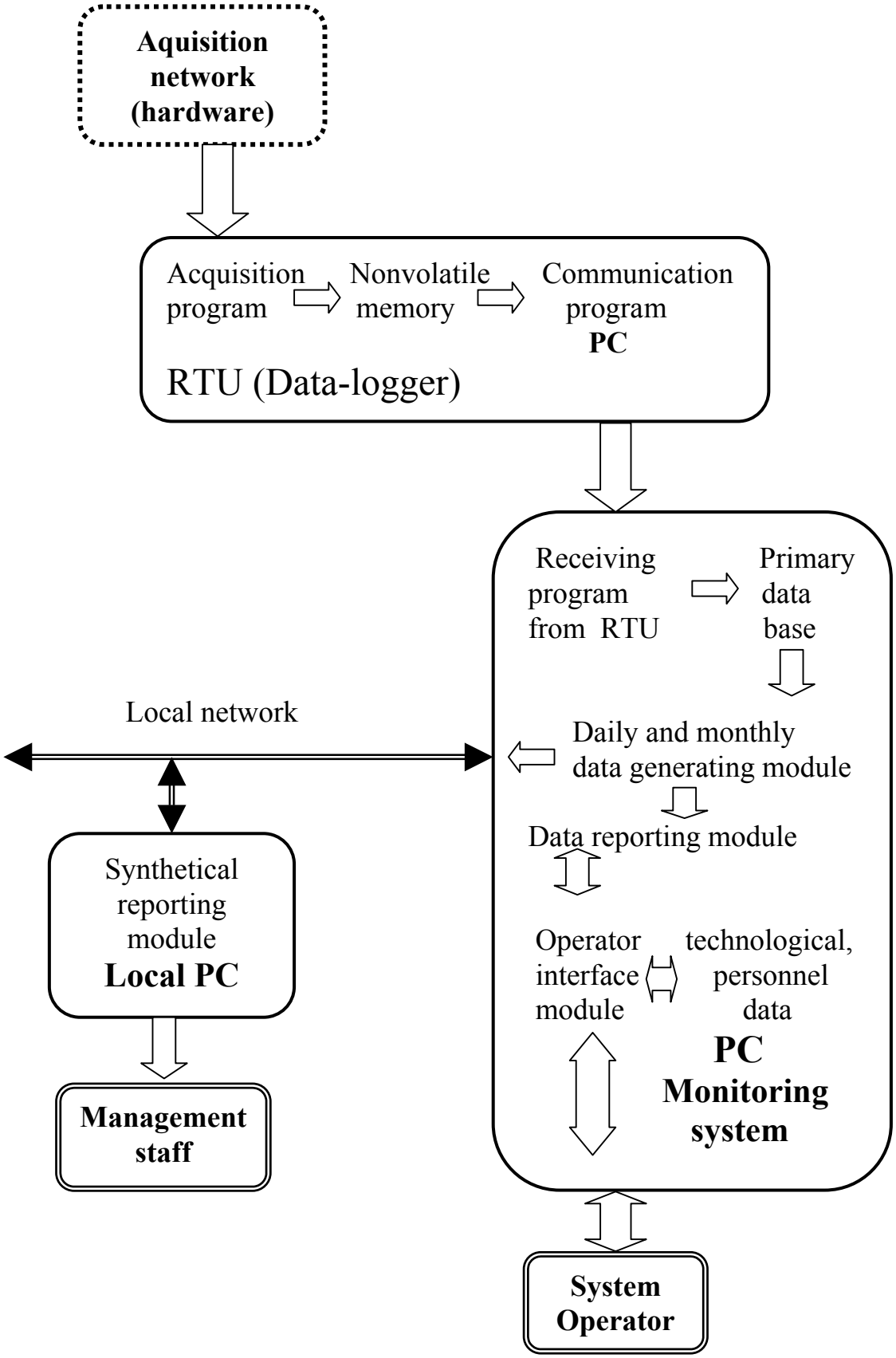

Fig.2. The structure and position of acquisition, monitoring and reporting software modules for spark plugs production.

Data from current product file and from allocation file are used for real time monitoring of current production and for generating of daily data bases.

Daily data bases are completed and validated by quality inspectors, who are typing at console the number of rejected pieces for the precedent production registration.

Data bases are accesed by reporting program modules for:

- production of individual workers and teams;
- production of one type of piece;
- work schift and daily production.

The valid production data are registered in monthly data bases ordered by product type and all technological flow. The registration is performed automaticaly, at every updating and validation of the production. Also, in monthly data bases there are registered by the workshop foreman:

- the launching of a product and updating of the launching;
- the changing of monthly stocks by operations.

The application program perform at every updating of monthly files the totalizing operation for final product and for associated operations. The monthly files are used for the following types of reports:

- monthly production for every technological flow;
- monthly production for type of pieces;
- daily production diagrams of finit products and intermediates pieces.

For easy performing of reports for previous months and years, the data bases are structured in subfolders of years and months, containg all registered monthly product data, in relation with the active personnel and technological lines in that period. A dedicated reporting program is implemented in local networking stations for the supervisory management staff of the plant.

4. Conclusions

The achieved system ensures the monitoring and optimising of the technological flow for spark plug production. The main enhacements of the technological process are:

- rigurously and dynamicaly planning of production;
- real time monitoring of production;
- detailed reporting for previous registered production on pieces and final production of workers, teams (daily and monthly);
- reduction of intermediates stocks of pieces.

Data bases are used in local network for synthetical reportings to management staff. They are the sources for a future integral informatical system of the plant.

References

[1] PROXISTOR AB Electronic Ltd.-UK - Inductive Proximity Switches
[2] HAMILTON – USA - Standard Magnetic Proximity Sensors Catalog-HPS 118800 30M
[3] CBM Electronics – Cluj Napoca – Senzori de proximitate inductivi
[4] National Instruments Corporation USA – LabWindowsCVI Visual Programming for Instrumentation

[5] Micronix RTU & Remote/telemetry Datalogger. Technical Manual