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### **NEW CONCEPT OF COMPUTER SYSTEM FOR HEAVY MACHINES**

The improvement of working conditions, safety of the machine and machine performance through the optimization and automation of the operational sequences are the major requirements for heavy machines founded in construction, agriculture, forestry and mining. Electronic systems are now playing a markedly increasing role in accomplishing the development objectives above, and have to be planned and implemented with care and foresight. Since 1985 in Institute of Heavy Machinery Engineering at Warsaw University of Technology had supervised several projects concerning heavy machine's automation. A backhoe excavator was developed.

The foundations of design were of two kinds:

- investigating and testing several concepts of system's architecture (i.e. hardware and software solutions) in order to choose the right one being suitable for mobile machine applications,
- developing a tool to measure and collect dynamical data of time variant parameters of heavy machine for research purposes.

The main goals were divided into the following categories:

- diagnostics of a machine, including monitoring of relatively wide set of parameters and preventing damages using warning and alarms,
- introducing an intelligent user interface for machine's operator, enabling the choice among several options while reducing the number of data being displayed simultaneously and aiding the operator in precise or blind operation,
- collecting of data measured by the system for free chosen set of signals, frequency and interval of recording,
- providing a framework for implementation various control algorithms starting from movement primitives up to sophisticated sequences optimised for several criteria.

As far as possible systems were built using factory made modules to reduce the cost of hardware design and testing.

The test stand and block diagram of system architecture are presented in Fig. 1 and Fig. 2.

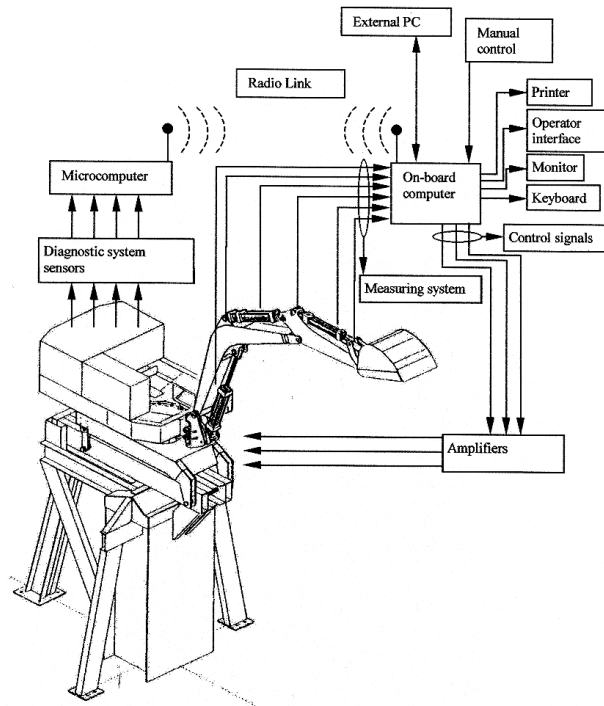


Fig. 1. Microcomputer controlled test stand

Recent developments of earth moving, mining, agricultural, forest and construction machinery has been characterised by continuously increasing contribution of electronic control system integrated into the machines. Machine manufactures must meet the new requirements including high performance, versatility, optional use of the engine, greater operator comfort, functional complexity, automation. The increasing application of electronics has the side effect which is very expensive and complicated wiring. There is the solution to the issues of increased systems integration and wiring hardness complexity: data-bus systems using CAN bus data transfer. The concept of the new control system of the stand based on CAN bus is shown in Fig. 3. Position and pressure sensors with CAN interface were implemented. Also the joysticks and proportional valves made by Danfoss, has the Can bus interface.

The main task of the present research program is to developed the application software in input/output service layer.

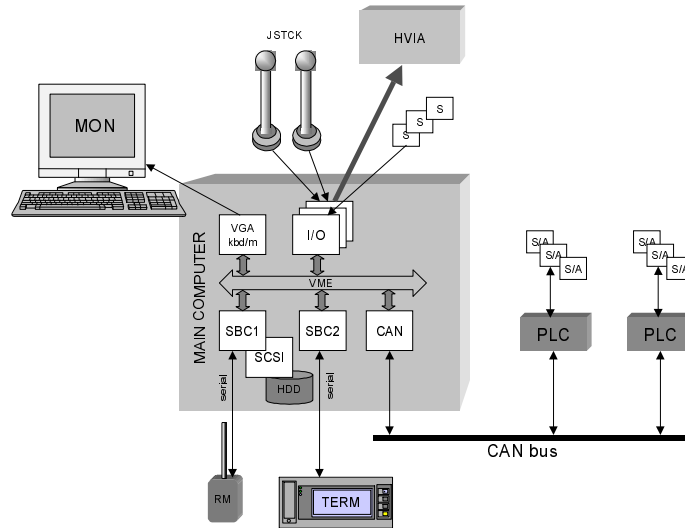


Fig. 2. Block diagram of system architecture

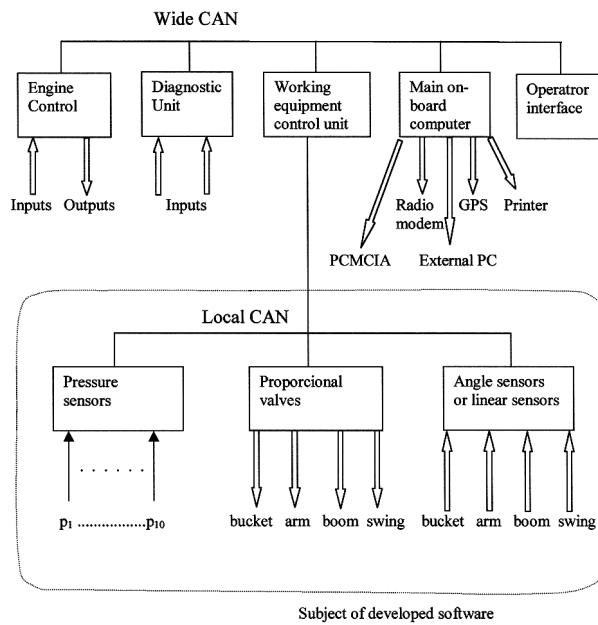


Fig. 3. Concept of the new system