

Customer

The Aladin company, supplier of components and comprehensive solutions for agricultural machinery.

Objective

To develop, conduct experiments and prepare design documentation for mass production of the in-car harvester-thresher monitor, which analyzes technological operating modes and controls harvesting parameters. The challenge lay in creating a competing product in price and under strict time constraints.



Solution

The development fit extremely tight timeframes, with the first prototype created in a month and a half after development had started.

Concept

A technical level map with comparison features of competitive products was compiled. On its basis, functional and technical characteristics for a new product were determined, plus some unique features were suggested:

- An event log to control the operating modes of the machinery;
- Custom sensor sensitive parameters for various crops;
- CAN interface.

"We were under very strict time constraints - we had to create sample prototypes to participate in the tender for supply of large consignment. We already started to get reconciled to giving away a part of the market to the competitors. At the end of January, we sent a request to the Promwad company asking to estimate the timeframes required to develop our product. The reply was rather unexpected - 2.5 months for the entire scope of work. We grabbed this chance, and as soon as in 1.5 months we received a first sample prototype that was highly appraised by the manufacturers of harvesting machinery..."

*Sergey Golubovich
General manager, Aladin*



In-car monitoring device for agricultural machinery

By agreement with customer, specification requirements for hardware, software, and design were elaborated and validated.

Hardware design

Promwad implemented an electric schematic diagram on the basis of the AT90CAN128 microcontroller, with a possibility to use MCU ATmega128 in a low-cost model. An interface with a high-resolution LCD was developed.

Power outputs and power circuit were protected from polarity reversal and short circuit, and integrity control was ensured for connection lines of external sensors. The device has an inherent capability of on-board programming and firmware update that does not require opening the enclosure. Large-scale nonvolatile memory storage allowed saving events with real time reference.

Design and ergonomics

An appealing and easy for the eye front panel represents a film membranous pad displaying intuitive icons. The graphical interface comprises around 30 screens with 240x128 resolution, thus making user interface convenient and adaptive.



Framework

The enclosure is based on the OEM solution by OKW. The enclosure design complies with the All-Union Standard on in-car electronic devices for agricultural machinery in dust- and waterproofness (IP65), shock and vibration resistance. The modular design simplified the assembly and increased repairability of the device.

The side panel of the screen has separate slots for the CAN interface, a technological slot and a programming slot. The device can be mounted in any suitable place of the driver booth with an external bracket.



Software

A sketch map of the graphical user interface has been made that became the basis of writing the GUI programming code. The algorithms of collecting statistical data about the machinery maintenance enable the warranty and post-warranty services quickly detect the source of trouble. A package of firmware and application software combines the graphical interface with technological machine control functions.



Quality assurance

At the beginning of design process, specification requirements were checked for compliance with the All-Union Standards, later at the prototype preparation stage the device was tested for compliance with specification requirements.

The user interface was field tested and received feedback from combine operators, which allowed making changes to increase the convenience of use.



Benefits and features

- Short terms and low project cost as a result of comprehensive approach to design;
- Convenient graphical user interface;
- High-contrast high-resolution screen in a low-cost device;
- Unique features that were elaborated after analyzing similar products.

Design tools	P-CAD, AutoCAD, CorelDraw, AVR Studio, IAR, AVR GCC
Technologies	CAN, LIN, FSTN LCD
Programming languages	ASM, C
Project management tools	dotProject, MSProject, CVS
Efforts	140 man-days
Duration	2.5 months