

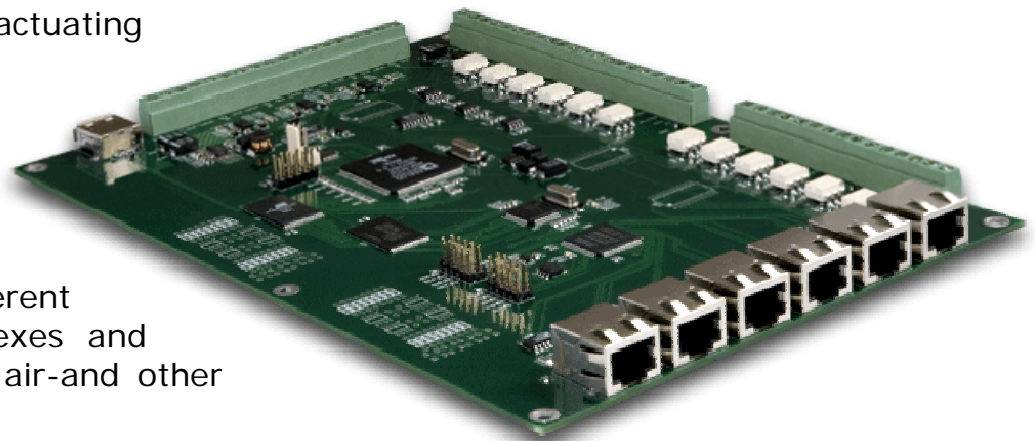
Customer

"The Planet of Attractions" Ltd is engaged in designing and manufacturing modern high-technology amusement parks.

Objective

The objective is to develop, manufacture and test experimental models of game platform controller. The controller must perform the following functions:

- Calculate spatial coordinates of platform location depending on game situation;
- Calculate motor control actions taking into account the inertia and characteristics of the platform;
- Store the settings and parameters of the platform in non-volatile memory;
- Use one hardware platform as simulator for different attractions and games;
- Interact with PC via digital interfaces;
- Process data from location sensors of actuating mechanisms.



The platform is designed for use as part of different amusement complexes and it works as auto-, air-and other motion simulators.

Solution

For the solution of the objective we suggest implementing controller on the basis of Analog Devices BlackFin BF532 digital signal processor. The solution is oriented to provide big computational power for executing control algorithms and calculation of spatial coordinates.

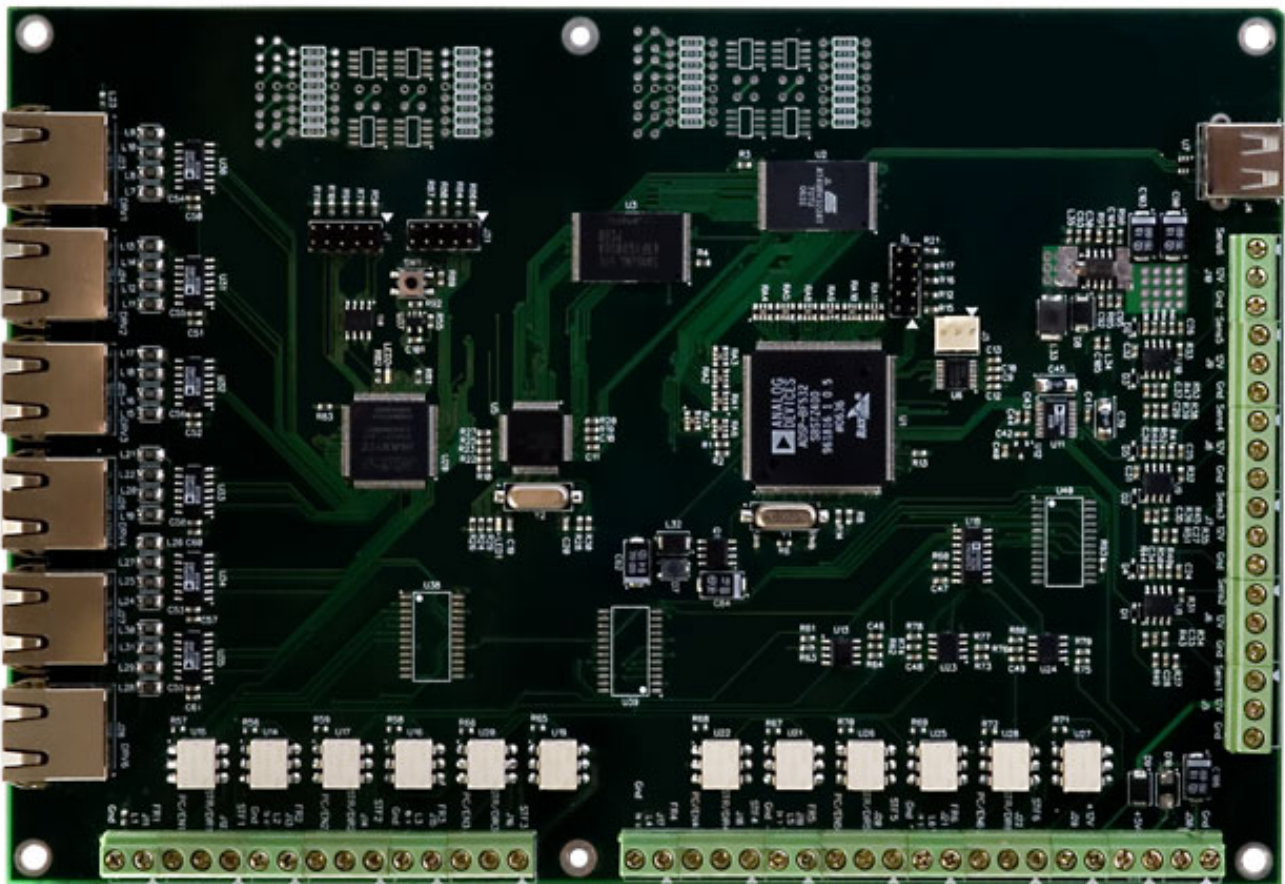
We applied NAND Flash Samsung K9K8G08U0M-PCB0 chip in the controller with the view to store big data array for various games and attractions, and built-in USB interface allows uploading all settings into the controller as separate files, as into general USB Mass Storage device. The developed protocol for communications of



High-performance servo-motor controller board

the device with personal computer provides the functions of in-circuit programming, interaction with game programs and functions of platform telemetry (automatic testing, control, operation modes, analysis of location and sensors' state).

The device can provide simultaneous control over 42 motors. It is possible because of six analog outputs for direct inverter control and six RS-485 digital interfaces built into the card. Each RS-485 (UART) interface, in its turn, can control six inverters. UART digital channels are implemented on CPLD microchip of MAXII EPM570T100 family.



The device also composes one analog channel for controlling over ButtKicker (ButtKicker is a dynamic speaker with extremely low frequency intended for vibration transmission to the seats). Communications protocol allows either receiving sinusoidal signal of random frequency (1-150 Hz) and amplitude or playing a definite track from sound gallery (clap, explosion, earthquake, engine roar etc.) at the output.

In-circuit device programming can be realized via RS232 or USB2.0 interfaces. The USB Philips ISP1362 controller used in the chip allows operating in USB Host, USB Device and USB OTG modes.



We implemented additional protection elements in connection with stringent requirements in electromagnetic compatibility (EMC), determined by close position of platform strength elements. EFT/ESD filters and optical relay were used in external communication interfaces to eliminate the noise influence from working frequency converters and powerful motors of alternating current. Analog circuits and digital algorithms of filtration were applied to eliminate noise of analog input signals from location sensors of actuating mechanisms.

Benefits and features

- The use of high-performance BlackFin BF532 processor allows application of complex algorithms for platform control with big quantity of degrees of freedom;
- The controller can provide independent control over 42 motors of alternating current;
- The controller can be used both as a part of game simulator and in training simulators for drivers of different transport vehicles;
- The device can be used as motor controller for different fields of human activities (for example, in systems of precise positioning of mechanisms).

Development tools	VisualDSP, P-CAD, Quartus, MVS
Technologies	NAND Flash, RS232, RS485, USB2.0, DSP
Programming languages	C, C++, ASM
Project management tools	dotProject, MSPProject, CVS
Efforts	65 man-days
Duration	3 months