NANOSATELLITE CONTROL DEVICE BASED ON ANDROID OS

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Recently, the increasing popularity in obtaining scientific data about the Earth and near-Earth space are scientific and educational nanosatellites, which are characterized by small size, but with a high level of hardware and software equipment for scientific and educational purposes for obtaining experimental data on the characteristics of the flight of the spacecraft.

The aim of the work is designing one of the subsystems of the nanosatellite-on-board computer, whose main task is to collect and transmit to Earth information on near-Earth space.

One of the main advantages is the low cost design of nanosatellite its subsystems. In particular, the lower the cost of designing on-board computer, can be achieved using the standard components and the operating system is open source.

The most suitable to these parameters is the Android operating system, designed for smartphones and Tablet PCs. Open access to the operating system kernel is one of the factors that contributes to the development of the software. While the Android platform and is designed to work with mobile devices, it had to give qualities to full operating system for the local computer, single board computer or computer nanosatellite.

The satellite consists of many subsystems, each of which performs its own specialized task. The primary function of the on-board computer, is to facilitate communication between the various components. Subsystem is usually physically placed in the various modules and should be reliable data bus, but since nanosatellite the often-limiting factor, some of the subsystems incorporated directly into the on-board computer. In this case, the software between the subsystems replace the physical connection, but the engine still must operate independently of each other.

To satisfy this requirement, a powerful microprocessor capable of managing multiple processes simultaneously. Process control should also be isolated from each other so that one engine failure which caused critical error of other systems.

Before choosing hardware onboard computer nanosatellite to derive the following requirements.

1) processing power:

The onboard computer must have one microprocessor with at least 900 MHz and the performance of at least 30 million operations per second, capable of performing complex tasks.

2) low energy consumption:

It is necessary to choose the components that are used in a variety of battery powered portable devices (cell phones).

3) Components with low feed voltage

To lower the power consumption, it is necessary to choose the components with a low feed voltage (3.3 v), against the traditional 5 v components.

4) availability of components:

The components used in the on-board computer, must be commercially available for at least the next three years.

To disable the microprocessor can only one particle radiation. Therefore, the on-board computer to use only proven architecture. Not every change can be run in the open space. In addition there is the problem of energy consumption — and the higher the speed, the more electricity to the processor.

Because of the proven reliability and versatility, choose the processor core ARM7, long proven in space. In reviewing several options, was chosen the most suitable AT91SAM7A2 processor technical requirements.

An onboard computer software, created an Android application to receive, compile and send the information to the PC with motion sensors is written in Java with Eclipse ADT plugin. The taps sensors accelerometer and magnetic compass, he calculates the rotation angle of the device co-ordinate system (associated with the device) on the global coordinate system (the Earth).

The application allows you to define the orientation of the device in space, its acceleration, and record all the data obtained in the *.csv file to SD card, then sending them to the dedicated server over Wi-Fi. For the *.csv file on the SD card needs about 100 KB of free space. The results can be transferred via Bluetooth. Next, the data can be processed to determine movement, speed and angles of rotation device

When the application starts, it fills the screen with a button labeled "start", you can then perform experiments with the device, click on the stop button. Then, in the special row is the E-mail address to which you should send the CSV file with the data.

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References

1. *A. Goloshchapov Google Android. Programming for mobile devices. Spb.: BHV-Peterburg, 2011.*

2. *Davydov A.S. Software development for Android//Tr. All. conf. Samara: SSAU, 2012.*

3. *Mayer, R. Android 2. Programming for tablet computers and Smartphones. Moscow: Eksmo, 2010.*