

TreeOS Brings A Significant Change To the MCU Software Development Model

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With the advent of the Internet of things, MCU's production has grown rapidly, with annual shipments exceeding 30 billion and annual growth of more than 20%. It is predicted that the world's internet-connected devices will reach more than one trillion in the coming 20 years. The future Internet of things is a huge and complex network formed by MCU. Despite the rapid development of hardware, the MCU software development method is relatively primitive and the development efficiency is very low, which can not adapt to the development of the situation.

Since the introduction of the first MCU chip in 1974, Intel has adopted the following traditional development process:

- 1) Determine product requirements, and decompose functions and select appropriate technical solutions and hardware;

- 2) Design the hardware circuit of the product;

- 3) Develop software architecture, such as choosing a real-time kernel for configuration, or build a framework based on requirements;

4) Develop or purchase various software modules, such as drivers, middleware, etc.

5) The two steps above constitute a basic platform of itself, and make further software development for application layer on this basis;

6) Debug and test the software and hardware, and complete the entire embedded product (in fact, it is necessary to debug the third ~ 4 steps continuously);

7) Post-technical maintenance improve product reliability to adapt to complex environment. In addition, products often need to be updated to improve performance or adopt new technologies.

In the process above, every step requires engineers to spend a lot of time and effort to debug and modify in the process. In addition, compared with PC software development, MCU software development is more difficult, mainly due to:

- Hardware with software together, adding many variables to debug;
- Many low-level development engineers need to learn related hardware knowledge now;
- There is no good, general development platform or operating system available for a variety of MCU;
- The environment is complex, that need the engineer

have rich practical experience, etc.

These causes lead to the development cycle of the product is very long, the development efficiency is low.

All of these factors, coupled with stringent development cycle and product cost constraint, which did a lot of challenges to the engineer and cause the engineers have no more time to consider the innovation and good user experience. In addition, the difficult and stable psychology of development also reduces the speed of product update iteration.

All of the above problems can be solved by a reasonable and reliable "TreeOS networking device development platform" which is verified by hundreds of actual cases.

In our more than ten years of development practice, it is found that the most important work in the whole MCU software development process is software architecture development and software module development (mainly Step 3 ~ 4). The subsequent integration and workload for iteration is also large, but it is affected mainly by these two steps. Therefore, the key to the development of software architecture and software modules can improve the development efficiency greatly and reduce the difficulty of development.

In response to this situation, after more than a decade of research and development, we have given a solution, including 5

parts:

- TreeOS general MCU real-time operating system;
 - TreeOS ComLib software library;
 - AlphaMcu A robot writes code automatically;
 - K11 A intelligent hardware development board;
 - Solution for TreeOS ;
- These products form “the TreeOS Internet of things

device development platform” .

First, you must have a general or operating system software architecture apply to different class of MCU , so convenient transplantation between software modules in a variety of MCU, maximize the code reuse of software modules, also can make the engineers fast and convenient use a variety of MCU, and meet the diverse needs of the embedded application. Obviously, it is a huge challenge to unify the nearly 10,000 MCU in a single platform. After many years of research and development, we have introduced the real-time operating system of the TreeOS for general MCU, and its software architecture can be used for all classes of MCU. The system has been applied in nearly 300 practical projects in over a decade, which proves to be feasible and reliable.

Secondly, TreeOS as the software architecture it develop MCU's configuration software, chip or peripheral driver, middleware, etc. They constitute software library the ComLib

software component library. Each software module in the software library can be combined freely to meet the user's various specific needs as soon as possible.

Certainly ComLib repositories is huge, in order to easy to use, we have designed AlphaMcu a robot writing code automatically. Then engineers input by using the method of simple configuration they can output the all the required software modules immediately. These modules have been changed, so can be directly compiled in the development environment. The code that used to be written in the past few months can be completed in a flash, and by statistics, the amount of code generated automatically can account for the entire project 70 ~ 90%.

In order to enable engineers to build the prototype of hardware quickly, we also launched the K11 smart hardware development board, which can be used to assemble the prototype of the desired product like building blocks.

The TreeOS platform has already packed the software architecture (real-time operating system), initialized configuration of MCU, driver, middleware, interface protocol, etc. Engineers don't like traditional MCU software development process start from the bottom of the drive, do not need to set up their own application development

platform can develop application development directly, it will greatly reduce the time for the development and certification, and help enterprises reduce the cycle of the products listed、 promote the upgrading of products and reduce the total cost of ownership of the products.

It can be seen that the TreeOS platform compare to the traditional MCU development process realized significant changes, which made MCU software development from manual mode to efficient intelligent mode.

Despite the current TreeOS platform with less than ten MCU products, ComLib only have some software modules used commonly , but for most applications can provide great help for engineers, and software library is fast, in order to meet users increasingly diversified demands equipment in the era of Internet .