

From "maker" PC to industrial computer

Can the Raspberry Pi, known as a hobbyist PC and widely used as an experimental platform, really score points with its cheap image compared to high-quality standard industrial PCs?

With an Raspberry Pi starter kit, Kontron is laying the cornerstone for industrial and commercial use of the Raspberry Pi platform in companies and organizations.

The requirements in industrial use in terms of performance, reliability, and long-term availability are many times higher than those of university labs or hobby rooms.

According to the experience of Kontron Electronics (formerly Exceet Electronics from Ebbs in Austria and now part of the Kontron and S&T), the rise of the Raspberry Pi is indeed unstoppable. This has less to do with the fact that it is technologically unique, but rather with the fact that it is well known and proven among professional newcomers.

In this, it is comparable to Microsoft Office or Adobe products: Inexpensive entry-level products are by their very nature popular in schools and universities for teaching purposes. Later, when pursuing a career, this experience makes it expedient for companies from a training perspective. Thus, they reluctantly settle for the unfamiliar commercial software.

This is also the experience Kontron Electronics has had for about five years: designs supplied by customers are increasingly based on Raspberry Pi prototypes. Customer side engineers and developers have been trained on this platform, which gets them results on low-cost platforms such as Raspberry Pi, Arduino, or Beagle Board quickly, with Raspberry Pi accounting for the lion's share. Kontron Electronics itself is not entirely innocent in this development, as Raspberry Pi is often used for bachelor's and master's theses supported by the company.

Customer side users and developers demand Raspberry

Kontron Electronics has many years of experience in selecting the right embedded platform for customer requirements and bringing an existing design draft to series production. This often means that complete designs based on Raspberry Pi needed to be developed from scratch in terms of hardware and software in order to obtain an industrial processor and board platform for series production. The financial and time expenditure for customers was correspondingly high, the product's time-to-market – from first draft to a production-ready platform – correspondingly long. For Kontron Electronics, this was reason enough to commit itself to establishing Raspberry Pi as an alternative – or rather as a supplement – to standard industrial platforms.

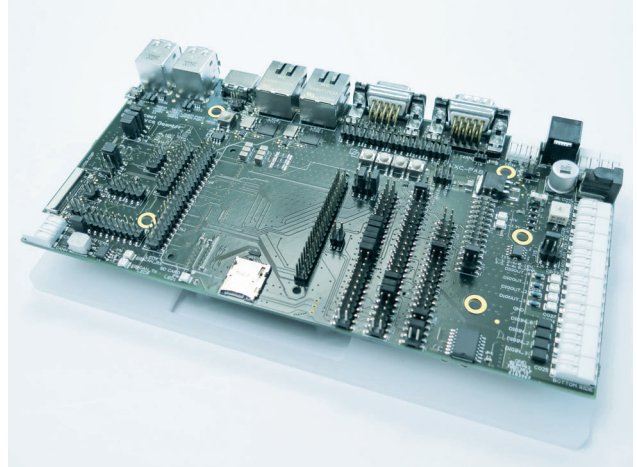


Figure 1: Raspberry Pi starter kit product photo (Source: Kontron)

Meanwhile, Kontron Electronics has completed the first commercial projects based on Raspberry Pi and can draw first conclusions. Counter to intuition, but not unexpected from a professional standpoint, the platform's low starting price doesn't translate to a low price in volume production for industrial use. It has been shown that for prototypes based on Raspberry Pi, converting them into an industrial product ready for series production requires consultation. In some cases, the resulting industrial platform is no cheaper than a standardized embedded platform. Kontron Electronics can even point to applications in which, after the consulting phase, it became apparent an industrial standard product was more cost-effective for series production overall.

Price does not always speak in Raspberry's favour

Often, however, the price is not the only decisive argument: What is sometimes more important about Raspberry is the software's ease of use. The Linux-based Raspberry operating system Raspian OS is very easy to use. Software packages can be easily installed subsequently, which saves time. Embedded Linux, for example, is much more difficult to install and administer. Here, too, the reason for its simplicity lies in the fact that the Raspberry was originally only intended for use in research and education.

This lies at the heart of yet one more reason speaking for the use of Raspberry: the available support from a worldwide community of fans and specialists, which no

Developer kit for Raspberry Pi

The developer kit for Raspberry Pi from Kontron includes a developer board compliant with SBC specifications, a Raspberry Pi Compute Module 3 Light, and an SD card with pre-configured Raspian operating system. With this offering, Kontron meets the development department's needs of various industries that develop prototypes based on Raspberry Pi, but have so far been reluctant to use the platform in industry due to a lack of professional support. In addition, many applications and programs that are freely available for Raspberry Pi from the open source community can now be used in industrial applications without any additional development effort.

commercially oriented company is able to offer. Particularly the fact that many students and young "makers" are committed to Raspberry leads to a high degree of openness and helpfulness, as is the case in social networks, which companies can also benefit from.

The size of this community also shows another advantage: the Raspberry platform was sold around 18 million times in total (as of early 2018). No standard industrial PC can match the size of this user base. A higher test coverage is virtually impossible, and the platform is correspondingly well-developed, which is why the "hobbyist" image is not as accurate as is often claimed.

The open source basis of the operating system and many applications, on the opposite, are only of limited benefit to industrial users. Although many applications are available under a free license, any adapted source code must also be published under the free license. Of course, many commercial companies find this difficult when the software "they own" has to be made available to everyone free of charge. The situation is not much different when individual modules from existing applications are used. Usually, programs derived from these modules have to be published under a free license in turn. However, those who are not dependent on Linux have the option of running Windows IoT core on the platform.

Disadvantages to be considered

Nevertheless, there are also disadvantages in the industrial environment for the use of Raspberry Pi that should not go unmentioned. One is the lack of standardization compared to standards such as Smarc, COM Express, or Qseven. In addition, the Raspberry is only marketed by the Raspberry Foundation or its distributors. Therefore, there is no variety, e.g. in terms of performance, power consumption, or equipment.

There are currently only two generations of processors available as compute modules: The Compute Module 1 from 2014 and the Compute Module 3, which was introduced early in 2017. Raspberry does not offer Intel, AMD, or NXP processor options for different applications. ▶

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Guaranteed long-term availability beyond seven years, such as Kontron offers for many standard industrial PCs, is not available for Raspberry Pi.

These disadvantages also show why a general statement as to which applications or industries the Raspberry is suitable for cannot be made. The choice usually depends on the application. Companies such as Kontron Electronics therefore offer an industrial starter kit, which can be used to quickly determine whether the Raspberry compute module meets the requirements. The starter kit has all the interfaces commonly used in industry, such as CAN, Ethernet, 1-wire, and EIA-485/EIA-232.

Especially the CAN network is used very often in the industry from automotive to automation products. Also the famous industrial protocol CANopen can be used, there are ports for the Raspberry Pi and also online tutorials. In some automotive application they are using the J1939 CAN protocol also therefore ports for the Pi can be found. The tried-and-tested circuit design and the standard industrial 24 Volt power connection ensure reliable usability. Further industrial analog and digital I/Os allow integration into predefined applications. The starter kit can be used to significantly shorten the path to the prototype and then to the finished product.

Raspberry application example in hospitals

In co-operation with a customer, Kontron Electronics has developed a mobile solution for the continuous real-time recording of vital data of bedridden patients. A contactless, concealed box located under the hospital bed measures and records vital data, and alerts nurses and doctors in the event of serious deviation. No direct patient contact is required to record heart rate, respiratory rate, decubitus, and fall prevention data. Thanks to the battery operation, the box can be easily installed under any bed.

During the hardware's development, the following technical requirements were also in the foreground: Linux support - in this case, yocto Linux was to be used; support for several interfaces such as WLAN, LAN, and Bluetooth; high computing power, which also allows machine learning; as well as the integration of an additional independent processor to guarantee the measuring results.

Certification as a medical device possible

In general, the product should of course be certifiable for use in a clinical environment: it should be approved as a Class 2b medical device, which corresponds to the second-highest class, such as for anesthesia and respiratory equipment. It should also comply with EN 60601, which defines safety and ergonomic requirements for medical electrical equipment and medical systems. In addition, fast implementation, long-term availability, and a good price-performance-ratio were required.

Together with the customer, it was decided to use Compute Module 3 for the product. Compared to the requirements, it had disadvantages in terms of power consumption and long-term availability. However, the

advantages in computing power, Linux support, and not least in the price-performance-ratio, made up for the disadvantages in this case.

The implementation was completed quickly due to the starter kit; the prototype's electromagnetic compatibility tests (which are most important for clinical environments) were satisfactory from the get-go. The interfaces could be verified very quickly with Raspian OS. Some problems arose around the transfer of the prototype to yocto Linux, but were solved with some help from the community, as well as the professional know-how from the S&T, which Kontron Electronics is a part of. ◀



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