

Development of an Android-based Tablet (Panel Computer series)

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Abstract

The recent activation of the tablet market is encouraging many enterprises to study the use of tablet terminals. At NEC, the Application Appliance Division has been developing products meeting various business operations and business type requirements in collaboration with each customer. For this opportunity, the division has commercialized an Android-based tablet by making full use of our rich experience. This paper introduces the convenience in actual business operations of this product, its features including stability improvements, the process of its commercialization and actual cases in which this product has been introduced.

Keywords

Near Field Communication (NFC), business operations, environmental resistance
wired LAN, customization, multi-user, tablet

1. Introduction

The launch in the market of the iPad by Apple Computers, Inc. has started the activation of the tablet market. The Application Appliance Division has developed an Android-based tablet (tablet-type panel computer, model name AGT-10) targeting various industries based on our experience of the commercialization of panel computers (Windows-based computers with touchscreen panel displays for various business operations and industry types) and have commercialized it as a product for new markets. In the rest of this paper, we will introduce the concept and features of this new product in section 2, the process of commercializing the product in section 3 and two cases of actual introduction in section 4.

2. Product Concept and Features

This product is positioned among smart devices such as the LifeTouch series and the VersaPro series and is specialized for the business operations/business type-specific product market. In order to cope with such markets, it has been implemented based on the Android platform with the three concepts of enabling its use by “anyone,” “anywhere” and with “safety and security.” With regard to specifications, it is a 10-inch tablet incorporating the basic functions required for a tablet and takes

into consideration convenience, stability and supply capability in actual business operations without compromising stylishness. The following subsections introduce its main features and functions.

2.1 NFC

NFC is currently used in communications with contactless IC cards such as FeliCa and MIFARE and its use is expected to become more active in the future. As a 10-inch tablet is expected to be used for reading and writing IC card information by waving the card over the product, it is very important to set NFC on the front chassis frame of the product without compromising the chassis design. For this purpose, we repeated four cycles of packaging studies and also repeated three cycles of prototyping and evaluation of the NFC module itself in order to improve its reading accuracy. As a result, we succeeded in packaging the universal antenna and module on the front frame of the tablet by reducing their area by 60% and volume by 10%. This allowed us to offer the world’s first tablet that can read and write NFC data on the front (**Photo 1**).

The NFC module is equipped with the SmartMX security chip, which has the highest level of security strength (certified Security Common Criteria EAL 5+). In the future, it will be compatible with a service that judges the authenticity of each terminal by verifying its legitimacy and internal ID data in the cloud computing system.

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Photo 1 Size reduction of the NFC module enabling IC card authentication on a tablet front panel.

2.2 Wired LAN and Cradle

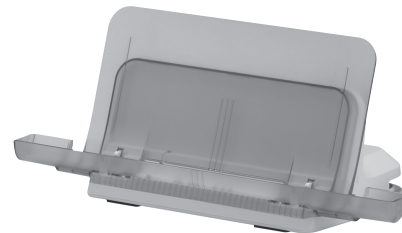
Tablets are generally carried for use, so they typically do not have a wired LAN function. Nevertheless, tablets are also used in a stationary position, on an office desktop, in many scenarios of business operations. In such cases, wired LAN is required to secure more stable communications as well as in consideration of the replacement of traditional panel computers. With this product, the wired LAN function (bottom left, **Photo 2**) is packaged in the optional cradle (top, Photo 2) so as not to spoil its portability as a tablet and also in consideration of the product design.

Specifically, the tablet and the cradle are connected through USB contacts (bottom right, Photo 2) and a USB-LAN converter chip is incorporated into the cradle. The contacts make use of the expertise cultivated through long years of business terminal development by NEC Infrontia to achieve plugging/unplugging resistance able to withstand business use. In addition to the USB contacts, recharging contacts as well as contacts for detecting the placement of the main body (bottom right, Photo 2) are provided, making it possible to identify the tablet plugging/unplugging count and to switch between the wired LAN and 3G circuits automatically.

In addition, to prevent theft, a hole for a Kensington lock and one for securing the tablet body with a wire are also provided.

2.3 Environmental Resistance

For business use, the tablet is expected to be used in severe environments, while avoiding the interruption of operations is important. Consequently, it is important to consider environmental resistance. The dust and drip proofing of this product complies with IP54 by adopting ultrathin packing at the



External view of the cradle



LAN port on the rear of the cradle

Connection contacts with the main device

Photo 2 Cradle incorporating a wired LAN system.

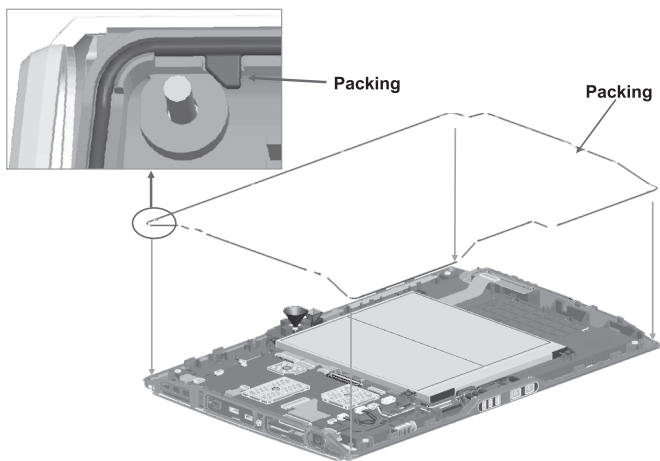


Fig. Chassis fitting using ultrathin packing.

mobile phone level in the chassis fitting section (**Fig.**). For protection in the case of accidental dropping from a desktop, it is designed as a robust terminal featuring drop resistance up to 75 cm as well as impact resistance.

2.4 Notification LED

One of the LEDs on the left side frame on the front of this product is a notification LED that can be lit by applications in any of seven colors. For instance, while viewing the screen

display with a customer, a sales engineer can be notified of information such as “there is an instruction from the store manager” without interruption of the screen display. By linking colors with message content, instructions can be recognized intuitively. It is also possible to assist awareness by including a vibrate function.

2.5 Easy Customization

Considering the usability in actual business operations, there are many cases in which it is inconvenient to use the standard product without change. To deal with this issue, we provided this product with our own innovations, assuming customization from the design phase, so that it can handle customers’ requirements flexibly and quickly. One is reduced board sizes and separation of boards (which are connected through cables) according to function in order to improve the flexibility. Individual components such as the camera are also installed by separating them according to function. These design measures make it possible to provide hardware variations, such as a model without a camera or a 3G-only model, relatively easily. Furthermore, to ensure flexibility of design, we stick to domestic development (both hardware and software) and domestic production.

2.6 Software Innovations Such as Multi-user Functionality

General Android terminals presuppose the use of a terminal by a single person, so they are not suitable for the sharing of a terminal among multiple users, which may often happen in the business use scenario. Therefore, we introduced the concept of multi-user functionality, like that available with Windows, to improve the convenience of business operations. In addition, we addressed terminal security by user authentication with the NFC function as well as with application usage restrictions (using a whitelist protection). The combination of these functions makes it possible to switch the user level (such as store manager or part-time clerk) of a business application after turning the terminal on to adapt to various other usage scenarios.

To improve kitting efficiency, a configuration application is included to enable batch installation of application files as well as some other operations including a LAN setting.

3. The Commercialization Process

As described above, this product is full of innovations allowing users to deal with various types of usage requirements. We believe that we were able to produce such a product not because we determined its specifications as an extension of general tablet terminals, but because we commercialized it by collecting needs from the specifications study phase through to the product shipment phase, always in collaboration between development departments, and by obtaining support from linkages between applications and services inside as well as outside NEC. In the following, the process of commercializing this product will be detailed.

3.1 Beginning of Commercialization

We began studying commercialization of products in early 2011 because we had requests from sales departments for an Android tablet specialized for business use and also needed to study the upcoming products in our division, products to be released next to conventional desktop type. We first presented the concept and specifications and exhibited the mock-up of the concept image at the Embedded Systems Expo & Conference (ESEC) in May 2011. As on that occasion we were able to confirm our production direction met customer’s needs, we advanced to the next step, consisting of a detailed specifications study and actual development.

3.2 Development System

To meet the challenge of developing this product with the optimum system, we organized a development base (a team of development personnel) with experience in the LifeTouch series by overhauling the development and production base of our division. We initially studied ODM (Original Design Manufacturing) by an overseas vendor, but decided to handle everything from development to production within Japan in consideration of the sharing of key technologies throughout the NEC Group and the possibility of flexible customization.

3.3 Shipment

The reactions to our exhibition and demonstration at C&C User Forum & iEXPO 2011 held in November 2011 made us reconfirm that our concept and direction were not wrong. After this we started to release proto-type models for applica-

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tion developers etc. We had their feedbacks such as unexpected usage scenarios and problems and implemented them in the product as far as possible. We continued to improve the quality of the product and eventually shipped in March 2012.

4. Actual Use Cases

In the last section, we will introduce two cases in which this product has been introduced in various fields thanks to the characteristics described above.

4.1 Maximum Use of NFC Built into the Front Chassis frame

In the first case, the orders for this product were received thanks to one of its biggest features, “NFC built into the front chassis frame.”

The customer was considering the possibility of introducing fashionable tablets to replace the current terminals used in their storefront service (business reception), which store visitors operate the terminal by their own using their membership cards as keys, with the aim of reducing system introduction cost and improving installation/operation performance.

Then, in place of the touchscreen panel display that customers currently used, we first examined the idea of employing a tablet which embeds the necessary peripherals (2D reader, contactless IC card reader, etc.) in a single box. However, from the viewpoint of cost, this proposal failed to be an attractive one for the customer, as it could weaken the advantage of introducing tablets.

We then proposed the maximum use of NFC built into the front chassis frame of this product. By employing some alternatives such as substituting a 2D reader for the built-in camera, we were able to obtain an order for a configuration consisting only of the tablet’s standard model. In addition, we also proposed customizing the software so that operability and controllability were not spoiled by the functionality of the Android standard (for example, illegal bypassing of the business screen by pressing the [Return] or [Home] button). This contributed to making our reception of the order certain.

The stylish cradle with highly durable contacts also was one of the product’s highly evaluated features.

The following points led to the success of this case.

- 1) NFC built into the front chassis frame (improved card authentication usability)
- 2) High environmental resistance of terminals against dust, drips, impact, etc.

- 3) Software technology and support capability for developing business applications
- 4) Stylish recharging cradle (high terminal plugging/unplugging endurance)

These are the major points in the first introduction case.

4.2 Specifications and Flexibility Responding to the Advanced Requests of Customers

The next case is an order from a financial institution customer. As with other business types, there is a great need for tablets in financial institutions and the introduction of tablets has been examined for several years. Nevertheless, general Android tablets were mostly excluded in the process of study because of many issues including short product cycles, security vulnerabilities that cannot be compensated for and the impossibility of customization according to actual operations. However, as our product clears all of the above issues, its introduction was decided upon as the first Android-based tablet for financial institutions in Japan.

The following four points led to the success of this case.

(1) Long-term product supply/maintenance

In a financial institution, it takes at least a year from the start of a terminal introduction study (requirements definition) to actual introduction and deployment. In addition, one of the characteristics of this type of user is to avoid adoption unless all of the product’s issues have already been cleared before the requirements definition. As it was required that the product already exist at the requirements definition stage and that it should continue to be supplied until the deployment stage, the long-term supply of the product was one of the important points that led to adoption. Maintenance was also required to be provided for up to 5 years after shipment and the availability of various options such as long-term warranty (3-year, 4-year, 5-year), remote locking, wipe and spare with a kitting service was also highly appreciated.

(2) Security

Since financial institutions handle sensitive personal information, they require the highest level of security and any user system has to pass severe security reviews by a third-party organization. This product incorporates all the security functions, often insufficient in ordinary products, that have ever been requested of us in relation to security needs.

(3) Customization

The hardware customization requests for this case included the packaging of the communication function (3G). The customer had been using iPhones and wanted to use the same carrier as before with 3G even when the terminal was switch-

ed to a 10-inch tablet. This product has a construction facilitating customization so it could respond quickly to the customer's request by simply replacing the internal 3G module.

For software customization, we customized even the parts close to the OS level in order to meet the highly stringent security requirements of a financial institution. Needless to say, the fact that engineers in our domestic bases can customize deep in the software hierarchy is one of the factors of superiority of this product over others. In addition, with options that become necessary in actual usage scenarios, quick proposals for privacy screen guard protection, adjustable power cable length and a group cradle (able to hold multiple smart devices) made it possible to incorporate them as added value.

(4) Easy introduction and deployment

As this case involves large-scale deployment, how quickly terminals are set up is an important point. In addition to making proposals to use the product's functions, such as batch settings, we also made full use of connections inside and outside NEC Group, including the linkage between the kitting and maintenance departments we had been promoting in advance, linkage with the carrier department and linkage with the terminal management service (MDM: Mobile Device Management) department. As a result, we were able to reach the final introduction decision quickly by omitting the time that would have been required for a study of proposals.

5. Conclusion

We succeeded in commercializing an Android-based tablet for the new market thanks to our many years of expertise in the commercialization of business-oriented products, the collaboration of related departments and the positive incorporation of customers' needs. In this paper we introduced two cases of introduction making use of this product's characteristics and we believe that these cases show the important points to ensure that this product will also be adopted in other business types. In the future, we will inherit and advance our expertise so that the product can grow to become easier to use and so that we can continue to deliver better products to customers.

* All other product names that appear in this paper are trademarks or registered trademarks of their respective companies.

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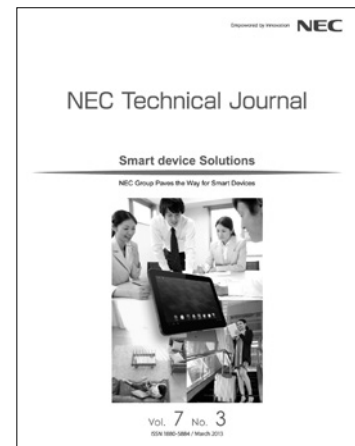
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