PCAP Touch displays - what does the future hold?

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In this article the author compares three different touch technologies and examines their suitability for industrial applications.

Figure 1. Example of a touch panel with Force Touch in a medical application

■ The triumph of PCAP Touch technology started in the consumer market of the 2000s. Displays with PCAP Touch have now reached professional products, and operating concepts with touch functions in industrial applications with one-finger/multi-touch, slides, etc are largely known, and functional principles and design possibilities are recognized. Research and thought in development departments is continuously dedicated to the development of demand-based, application-specific and potential revolutionary touch methods/technologies. Which current enhancements and further developments are promising and/or upgradeable? For which applications in which industries would certain specific technologies be useful/possible or even necessary? What could touch panels of the (near) future look like?

PCAP Touch technology is a familiar element of everyday life as well as of industrial products of all industries. Technical features such as operation under water or with gloves, an extended temperature range, EMC conformity and various assembly options for different requirements (SITO and OGS touch displays, film/film and glass touch displays) today are included in the scope of supply of a PCAP Touch control unit. The technologically highly specialized optical bonding is provided by various suppliers such as Data Modul in differing quality. Three variations of demand-focused operating concepts of added value built upon the existing projecting capacitive technology or enhancing this are currently the focus: PCAP with haptic feedback, with gesture control and with Force / 3D Touch.

Touch panels with haptic feedback confirm, via direct re-transfer of the force to the user, their interaction on the touch sensor. Eye contact is therefore not absolutely necessary for this. The user ascertains the position of their finger on the sensor on the basis of the tangible feedback alone, and their interaction is thus confirmed. An extension of this kind is conceivable in applications where the user must be focused on an object/a patient/an action near the screen. Scopes of application here include the medical, automotive and entertainment industries. However, in many applications, a touch operation without eye contact is (still) not required. The benefits of haptic feedback are initially limited: as a general rule, device users see simply touching the surface as a sufficient form of tactile feedback for interaction confirmation. Integrating this additional function into an existing application is complex and expensive. It is necessary for the entire mechanical concept to be adapted, as the tactile providers of feedback, the mechanical actuators (vibrating motors, Piezo elements, linear drive mechanisms), also have to be integrated. To enable the feedback in the first place, the surface has to be integrated in the casing on a floating basis, as otherwise no vibrations or the like can be transferred to the user. The moving medium (mostly touch and cover glass) is a factor that must be considered, as, in industrial applications, the cover glass that has to move is over 2 mm thick. This means that the requirements surrounding, among others, the system stability, lifespan, power consumption or the exertion of force on connecting elements cannot be fulfilled to optimum effect.

Hover gesture refers to the touch-free interaction through gestures in a defined space and over given axes (X, Y, Z). The identification of gestures takes place either via an electromagnetic field in addition to a touch surface, or completely on camera basis. The GUI of the display is not covered by the fingers, and the view of the screen remains unimpaired. The surface is almost completely unaffected by soiling, and the interaction with the touch sensor can take place without eye contact. The user behavior is determined by familiar operating concepts: on a screen, a user mostly resorts to learned operating patterns. The user experience crucial for product success is unfamiliar due to the gestures that need to be learned. To adapt HMI systems to gesture control, wide-ranging adaptations in the GUI

Figure 2. Schematic layout of a Force Touch panel

design are also required, and it is also necessary to reconsider the usability. This technology (still) does not meet the requirements for safety management in the industry, e.g. implementation of redundant systems; an erroneous activation due to incorrect recognition is possible. Camera-based recognition of gestures was successfully integrated in gaming and automotive applications, but the attempt to introduce hover gestures in the mobile telecoms market was less successful.

PCAP with Force or 3D Touch has the greatest development potential in the industry. The pursued goal here is to recognize a change in the Z axis and thus the level of pressure applied by measuring the surface of the touch point. The exerted force can also be measured through additional pressure sensors. With mobile devices that have thin cover glass in particular, the surface curvature of the glass is thus measured. In the case of Force Touch, the interaction takes place independently of the pressure applied to the touch surface, which means that additional possibilities for use are available on the interface. The classic right click on the mouse can then potentially take place by increasing the input pressure. The redundancy of the signal evaluation is one of the important details for industrial production. This occurs in the case of applications with Force Touch via touch controllers and of evaluation electronics such as that of force sensors. The function of the device can then be triggered - if desired - when both signals are registered. This is an essential requirement in medical applications. This dual channel redundant touch recognition could be a useful addition e.g. in intensive care. Especially since the PCAP operating unit remains insusceptible to conductive fluids, as it is triggered without additional pressure despite the electrode short circuits of the touch. Force Touch provides advantages in the development of industrial PCAP enhancements of added value, so the Munich-based visual solutions provider Data Modul is focusing on evaluations with force sensors which are integrated in the edge of the touch sensor. Cover glass in the industry is usually too thick for the measurement of the surface curvature on the touch glass (> than 2 mm) and high-resolution touch sensors for large diagonals (> 15.6”) are difficult to create.

An existing package consisting of TFT, touch glass, cover glass with optical bonding can be used almost unchanged as a starting basis; the enhancement with Force Touch takes place on an additional basis; the industrial customer does not have to go without the existing benefits of touch technology, such as complete protective glass. But this enhancement represents a challenge for existing client applications. The touch unit provides the touch coordinates plus the force values per coordinate, but the software must be able to interpret these. This means: a consideration of the respective adjustment of the client software and of the graphic surface (GUI, usability) in product development/conversion. Force Touch systems require proprietary driver solutions. There are no standardized interfaces so far; isolated solutions are a valid possibility here.

The bottom line: PCAP Touch technology has found its way into professional operating concepts via consumer products. This has increased user expectations/wishes/requirement/demand for operating concepts of a similar kind in the industry. The successes and potentials of all current and future further developments are exclusively defined through usability and design. There is no significant demand for hover gesture in handheld devices and mobile devices in the consumer market or in the industrial market, and, so far, PCAP with haptic feedback has not taken hold as a technology in consumer electronics, nor is it found much - following the chronology - in industrial applications. However, in critical industrial areas with high safety control specifications such as intensive care or the food sector, the benefits of Force Touch technology are evident. The redundancy functionality combined with the tested PCAP Touch technology meets the user basic requirements. The integration of sensors for the measurement of mechanical force absorption or the touch-triggering surface remains a challenge. The latter requires special, non-standardized touch controllers and high-resolution touch sensors for touch surface measurement, development expertise and technological research. The market response will ultimately show which of the PCAP enhancements will take hold. A combination of several technologies such as haptic functions and force sensing remains promising. ■