The Development of a Computer Human Interface using Touch Input for Point of Sale Applications

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This was a joint project between PEC (New Zealand) Ltd. and Massey University.

PEC

Massey University

Abstract

This project developed a touch screen interface for a new generation EFTPOS sales terminal at the fuel pump in a service station.

Scenario plans and creative observation of consumers and analysis of their expressed needs, wants, and requirements were developed within the context of the client's specifications. This enabled the production of a physical and graphical user interface that provided initial appeal, ease of learning, high speed of user task performance, low user error rate, subjective user satisfaction, and user retention over time.

Using multimedia computer software as a rapid prototyping tool enabled realistic feedback to be obtained early in the development stages and facilitated the modification of prototypes to minimise the barriers to potential consumer acceptance.

The designer was able to effectively communicate the goals and details of the product to the team implementing the design using flow charts and diagrams to define the structure and content of the interface.

The process used to develop the interface was compared with published product development techniques that incorporated consumer testing checkpoints throughout the discrete phases of product creation. It was determined that the generic processes were useful in practice, but only if the checkpoints were chosen appropriately and the tests customised for the developing product.

Testing at fixed stages in the design process was found to be detrimental to the project. Putting excessive emphasis on the testing of the product curbed creativity by removing valid solutions before they could be investigated fully.

The touch screen interface developed will be used to lead customers through fuel deliveries, Electronic Funds Transfer (EFT) transactions, and the purchase of other service station related products and services. The interface allows incorporation of advertising and customisation for use in other countries, meets the company's specifications, and has polled well in consumer tests when incorporated in a simulated mounting.

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1 Introduction

The project was commissioned by PEC (New Zealand) Ltd, a company specialising in innovative and high technology products for the oil and security industries.

The product required was a touch screen graphical user interface that was to be incorporated into a Forecourt Service Terminal (FST) being developed by the Company. The point of sale device would be located at the petrol pump in service stations. The FST would allow customers to purchase fuel and other products using EFTPOS, fuel, or local cards at the pump. The FST builds upon another product that PEC currently have on the market that enables a customer to purchase fuel using an EFTPOS card at the pump.

The projects joint aim was to present a practical application of the theoretical product development process and to apply generic product development techniques to guide the project through the appropriate design, prototyping, and testing phases.

The theoretical product development process as applied to the interface development was as follows:

- Clarify PEC's needs;
- Analyse current systems and practices;
- Define product specifications;
- Generate product concepts by creating a simple storyboard based on the specifications then develop the storyboard to incorporate innovative options;
- Develop selected product concept and produce a multimedia interface to fit;
- Conduct initial consumer testing to canvas consumer and technical opinion, then modify the storyboard and prototype accordingly;
- Develop the physical aspects of mounting the user interface and model the options;
- Develop product detail and prototype the interface on the computer;
- Consumer test the product to identify areas of acceptance and areas for modification;
- Refine the product design and repeat testing and modification until stakeholders are satisfied with the design;
- Prepare a formal project report;
- Submit the product to PEC for incorporation into the next stage of manufacture.

The resulting touch screen interface is innovative, technically sound, is inviting to customers and easy to use, allows incorporation of advertising and customisation for use in other countries, meets the companies specifications, and has polled well in consumer tests when incorporated in a simulated mounting.

Published product development techniques which incorporate consumer testing checkpoints throughout discrete phases of product creation were found to be useful in practice, but only if the checkpoints were chosen appropriately and the tests customised for the developing product. Generic methodologies need to be translated and adapted for the particular product area and type.

2 Project Background

2.1 Sponsoring Company

PEC (New Zealand) Ltd is a company specialising in innovative and high technology products. They have been working to meet the needs of customers, including oil and security industries, since 1947. Under the main PEC (New Zealand) Ltd umbrella there are three business units:

- Retail Solutions - world leading retail automation systems,
- Cardax – integrated security access control systems, and
- Pumps – sophisticated fuel dispensing equipment.

All the business units are based at sites located in Marton, where each unit can benefit from the technologies used and developed by the company. PEC currently houses an extensive multidisciplinary product development group consisting of over 100 technologists.

PEC's products include point of sale, fuelling, and security control systems, and are sold in over 30 countries.

2.2 Rationale

In 1991, PEC began the design and development of a card reader system to be located in the head of existing petrol pumps. This product would allow for the purchase and payment of fuel at a pump on the forecourt of a service station. Similar products combining a card reader with a pump had been available for a short time on the international market and had a small following. It was PEC's vision to redesign an indoor point of sale unit for mounting at the pump to create a "Forecourt Service Terminal". Unlike a straight card reader and pump, the unit would have the capability to sell more than just petrol. For PEC, the development of the Forecourt Service Terminal (FST) was a natural progression building on their experience with both card reading and petrol pumps in their existing product lines.

2.3 Current Product

In 1993 tooling for a prototype run of Forecourt Service Terminal (FST) units was completed. The first FST units were then produced for customers in Brazil and Hong Kong. The units were purchased by the customers for very different reasons. For Brazil the purchase of around 60 units came at a time where policy changes meant that service stations were being upgraded. The fitting of the FST units added an extra feature for the service station at a minimal extra cost. For Hong Kong, with extremely busy roads, the installation of the FST units increased productivity at service stations while decreasing fraud. Each pump and FST could be assigned to a different attendant (attendant tagging), with all sales being run through the FST by either the customer or the attendant. FST units have since been installed in New Zealand, Australia, South Africa, and Malaysia.

Figure 2.1: Current Forecourt Service Terminal (FST)

Figure 2.2: Forecourt Service Terminal (FST) variations

The FST is produced in three different colours of plastic, which is then pad printed with the appropriate text. There are currently around 15 variants of the FST front. Each customer has their own combination of colours and text, making the front end of the unit a costly item to produce, and an item which can only be sold to the one customer. Due to the high level of customisation of the FST front, holding the unit in stock is not cost effective.

The FST has been very successful. The tooling, which was intended to cover a prototype run of no more than 500 units, has produced around 14 000 units to date.

The first major break in technology for the FST came from a need to include Smart Card transactions in the South African market. The use of different types of card was not envisaged in the initial design of the FST, but a successful solution was found.

2.4 Product Intent

The FST had always been sold as a unit with the capabilities to sell other products, however, in reality when a customer wanted to be able to sell oil from the FST, it required extensive input from software engineers to add that one function.

Changing the original design to include today's additional requirements is becoming harder and more time consuming. The cost of customisation is inhibitive.

In 1994, PEC began work on a model upgrade for the FST. The reasoning behind the upgrade was to provide a system that required less support from PEC staff. This upgrade would be achieved by producing an FST that was driven more by the software than the hardware, allowing the unit to be customised more easily.

The development of concepts for the new FST were based around known strengths and weaknesses within PEC's existing range of products. The major strengths identified for the current FST unit included:

- The ability to be mounted into the majority of existing petrol pumps,
- The ability to be combined with another PEC product, a site controller, to supply a complete service station solution.

The new product had to be easily customised, with functionality that was flexible to meet the needs of individual markets. It was decided that using a flat panel Liquid

Crystal Display (LCD) screen with a touch overlay in the FST mark 3 would provide a suitable solution to facilitate customisation. The physical user interface would be able to remain the same throughout all the models, while the screen would contain the customisable text, graphics and content.