NFC 3-Stroke Configuration & Mobile HMI apps

- **On-board HMIs are costly and often un-used. Is there another option?**

LCD / Keypad-based user interfaces are commonplace on today's appliances. However they present a host of drawbacks from high costs to low user esteem. Why do appliance manufacturers persist? Are there other options? This article looks at one alternative— the mobile phone. They are everywhere. Consumers know them intimately and expect to use them… everywhere! Can your company leverage this unshakeable truth? We'll discuss just that in this article from our NFC and mobile experts at IoTize.

The Trap of LCDs, Buttons and Keypads

Increasingly, systems require programmable electronic controls. In some cases those controls will be required by laws or safety standards. Take for example electric radiators: European legislation now requires built-in controls for programming hourly usage, which necessitates a moderately complex HMI. As soon as equipment like this requires such configuration, it also requires a Human Machine Interface (HMI).

The first instincts of the designers of these systems will be to create an LCD-based HMI. The most common solutions for this are either an LCD display and navigation keys, or a tactile LCD. Both solutions are frequently used in industrial equipment and consumer appliances.

Best User Experience & ROI

Choosing to design an HMI is not a decision to take lightly. The choice has long term implications in an appliances development cost, material costs, maintenance and management.

Moreover, the results are often only somewhat convincing for the appliance users. The interface logic is specific to the manufacturer. Using the interface often requires having a user's notice in hand. Once that happens, HMI designers know they are a long leap away from "user friendly."

For example, Manufacturers of radiators state that only 20% of their customers take the time to program their product because it is so tedious. The large majority of users never benefits from the control features the manufacture offers, and cost savings that should result.

Mobile apps become viable HMI alternatives with NFC

Mobile phones are the new alternative to the on-board LCD. Plus, they are an alternative for appliance manufacturers that is much more accessible than one imagines.

Because mobiles have won global acceptance as our information appliance of choice, they have also become the standard by which other HMI are judged. Mobiles benefit from software distribution and update mechanisms that are efficient and transparent to users. Consumers are intimately familiar with mobile interfaces. They use them daily –

there is no better school than that. This is to the extent where Android, for example, is becoming a reference for designers of embedded user interfaces. But why mimic the user interface that you already have in your pocket when you really just need to connect it to the appliance?

Here in lies the key initial hurdle for most manufacturers – what connectivity to use? Having a user connect wirelessly must not be more complicated and less secure than fumbling about with an on-board user interface. In both of these aspects NFC leads the other wireless interfaces found mobile phones.

The reassurance of proximity

For the end users of an appliance, connecting using NFC is incomparable to other technologies on the mobile. From the first connection the only challenge is approaching the mobile's antenna to the tag on the appliance. Otherwise the "touch-to-connect" gesture is as natural as flipping on a switch.

"Touch-to-connect" makes NFC reassuring for the appliance user. First, accessing the appliance implies just that… physical access as NFC range is limited to three to five centimeters. This is an important reassurance to consumers who are increasingly worried about hackers compromising networks and our households remotely.

The security of proximity

"Touch-to-connect" is also virtually instantaneous once one is familiar with NFC on their mobile. When the mobile set to vibrate when a tag is detected, the experience is almost just like pressing a button. In that instant of first contact, a chain of activities ensue over NFC that makes connecting "automatic" and perfectly transparent for the user. With a simple gesture, NFC:

- Launches the appropriate application on the mobile
- Wakes up available Bluetooth or Wi-Fi channels (if desired)
- Authenticates and builds encryption keys for the session
- Pairs and switches to other channels (if desired)

Note that it is also possible to maintain communication over NFC indefinitely provided the mobile remains within about three centimeters of the tag (ex. we do this at IoTize for device programming in some cases.).

The ease of 3-Stroke™ configuration

This use in the TapNLink NFC modules is the direct result of NFC "touch-to-connect." An NFC tag used alone is a powerful, efficient and cost effective wireless channel. However keeping a mobile against a tag for an extended time is impractical. This is especially true if the user has to do anything on the mobile during the communication.

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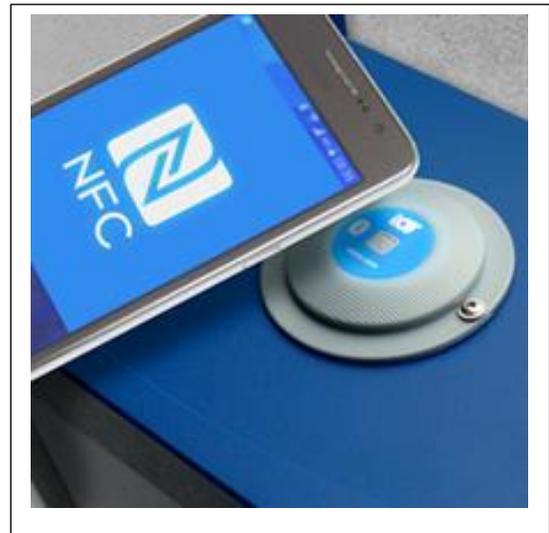
NFC 3-Stroke^{TM} configuration apps reduce configurations to a simple, intuitive process:

- **Acquire**: Approach the mobile to the NFC tag to launch the app and acquire the equipment's current configuration.
- **Modify**: Take the mobile back. Review the acquired configuration and make modifications to parameters using the mobile app.
- **Update**: Approach the mobile to the NFC tag again to transfer the revised configuration parameters to the equipment.

Acquisition (reading data) and Update (writing data) are generally quite rapid. This is just the duration of the gestures of approaching the mobile to the tag and bringing it back. This simple gesture is where we see NFC's advantages:

- The selection of the equipment is intuitive and simple. There is no need to 'scan' for, or select an available connection.
- The mobile and the desired equipment are paired and their connection is secured automatically.
- The appropriate application is launched automatically.
- The equipment does not emit advertising signals that increase power consumption and unnecessary emissions.

In this scenario, NFC advantages overs BLE or Wi-Fi include:

- Economies in material investment and energy consumption
- Decreases in unwanted, excessive radio emissions
- Improved security and discretion
- Improved convenience in establishing and securing the connection, and launching apps

NFC 3-Stroke Configuration & a Radiator HMI

In the case of our electric radiator, this appliance fits perfectly with NFC. The interested user has access, ownership and responsibility for the appliance. Remote access is not possible for anyone who does not at least have physical access. TapNLink NFC modules can also be configured to manage a user login if physical access is not already enough of a restriction. In this case the mobile app requires the user to

login. The access parameters are part of the TapNLink's configuration.

A configuration of the appliance might be done initially at installation and periodically (monthly or yearly) if the configuration is lost (ex. a power outage) or if conditions require it (ex. "a particularly warm winter"). For this use, have a permanent network and a monitoring Cloud software aren't really necessary. Moreover, this imposes greater risk of hacking or loss of personal data.

Managing the configuration on the tactile screen of a mobile is clearly much more accessible to users than an on-board HMI. For the user no more hunkering down next to the radiator in dim light poking at buttons to navigate and change the configuration.

The user only lowers his mobile to touch the tag on the radiator. This instantly and automatically pairs and secures the communication, captures the actual configuration and opens the correct app to display the configuration.

The user views and changes the actual configuration easily. Mobile screens are larger than the LCDs on radiators. The navigation and controls are familiar. The screen is tactile. Note also, the manufacturer creating the app benefited from libraries of graphical controls that are commonly used in mobile apps. It is not a question of inventing the right controls, but of choosing the right interface controls to view and change these parameters.

When the user is satisfied with the changes, a simple touch to the tag uploads the new configuration to the radiator. It is all done in three simple and intuitive steps.

Manufacturers advantages to using TapNLink NFC

TapNLink is conceived to provide the connectivity, security and ease-of-use that end users want. However, the TapNLink approach has remarkable advantages for appliance manufacturers. Everything is done to remove the technical hurdle from wireless integration, security and mobile app generation.

TapNLink NFC modules are a complete, fully tested NFC design and antenna. They eliminate the need to create any hardware when adding them to the appliance. All that is necessary are two wire connections to the processor that controls the radiator.

TapNLink modules are designed to act on the target processor like a configurable spy. TapNLink is configured by the manufacturer to access specific data, the type of access (read or read/write) and access restrictions. Some firmware modifications may be necessary, but the code is generated automatically based on the manufacturer's configuration of TapNLink.

The manufacturer decides how data should be represented, and from there IoTize's configuration automatically generates apps for Android and iOS mobiles. Creating new apps is as easy as changing the configuration and clicking a button.

The apps are complete, independent apps (APK or IPA) that can be published on app distribution platforms like Play Store and App Store. Based on a standard framework for cross-platform apps, the generated apps can also be evolved by the manufacturer to integrate more complex features such as:

- Storing a history of retrieved data (ex. users store past configurations so they can revert back to a previous one)

- Capture information from mobile features (ex. GPS, camera, contacts, etc.)
- Transfer information from the mobile to a server / Cloud applications (ex. send data to the manufacturer's support engineers).

While advanced functionalities will require additional expertise and effort to develop, there is nothing to do at the appliance level other than add and configure the TapNLink NFC module.

It has never been easier to create connected appliances

Evolutions in Near Field Communication support under iOS and Android make a NFC an increasingly advantageous solution for interfacing mobiles with virtually anything. Even when tags like those used in TapNLink support bi-direction communication, they still come at a fraction of the cost of BLE or NFC chipsets. As NFC familiarity grows with consumers, expect to see more NFC in more applications… including on your next radiator.

Certainly, now is the time to leverage these trends to eliminate those additional costs caused by legacy on-board user interfaces. At the same time, manufacturers who take this route can expect to win user satisfaction, very simply, by allowing user's mobiles to communicate with their appliances. If you're intrigued by the opportunities, IoTize provides a simple project calculator for evaluating the Return On Investment of integrating connectivity and mobile apps with TapNLink… or without. Take a look, the numbers may surprise you.

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