Create Mobile HMI for PLC in Minutes

FIELDBUS TO WIRELESS FOR MOBILE HMI WITH IOTIZE | NOVEMBER 2022

Expensive LCDs Make Inefficient HMI

Even in the age of the Industrial Internet of Things (IIoT), technicians still interact with machines on-site. Today, the most common interfaces for viewing and changing equipment parameters on machines are LCDs and push buttons or key pads.

During commissioning, daily operation and periodic maintenance, technicians use these LCD-based Human Machine Interfaces (HMI) to verify performance, check system parameters and adjust or re-calibrate systems and sensors.

But these interfaces are woefully inadequate for these tasks. Parameters and data are difficult to navigate, view and modify on the LCD. They require technicians to work in close proximity to moving parts and high voltage. **Poor visibility in these hazardous conditions make technicians less efficient and contributes to human errors.**

The mobile app solution

Mobile phones have become our information appliance of choice because of their user-friendliness and omnipresence. Their role in our lives is only growing. Replacing the LCDs on equipment with mobile HMI is only natural because of the many advantages that apps offer:

- Reduced development and production costs
- Increased comfort for users
- Possibility to authenticate users
- Possibility of over-the-air firmware updates and other remote operations

A whole realm of possibilities opens to machine manufacturers via mobile apps, and at a much lower cost than with traditional LCD-based user interfaces.

The Industrial HMI Challenge

LCD & push-buttons are expensive solutions that result in industrial HMI that are inefficient and difficult to use...

Easily Solved

Mobiles & apps offer an easy-to-use, adaptable solution that is made accessible by our no code solution for industrial equipment...

The IoTize Way

Relying on pre-implemented features of our industrial wireless devices, and our software ecosystem makes HMI creation accessible to absolutely anyone.

If you need more flexibility, our advanced features let you do anything you want with a little bit of Java...

Mobile HMI for Industrial Equipment

Easier to Implement Than You Imagine

Mobile HMI app and PLC with Tapioca

IoTize provides **a low code wireless solution that connects any fieldbus-equipped machine to mobile apps or the Cloud with very little effort**. It comes in the form of Tapioca fieldbus-to-wireless adapters or TapNLink wireless modules. In these devices, all the common features that are required in connected machines are pre-implemented including communication protocols, access control and encryption.

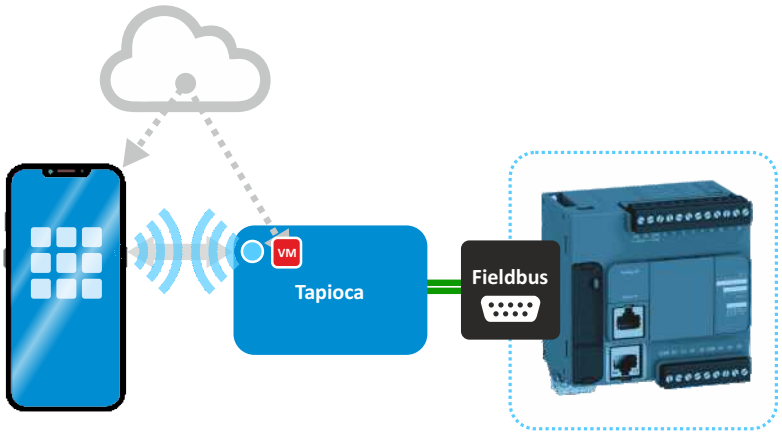
The solution even goes so far as to provide your users with a customized HMI in the form of **our Adaptable HMI App**, or as **apps that users create themselves** with the help our Automatic App Generator.

Connecting Wireless Devices to PLC

There are several methods for creating connected machines using IoTize wireless devices, including:

- **Retrofitting a Tapioca adapter on a machine's fieldbus** port that supports the Modbus-RTU or Modbus-TCP protocol.

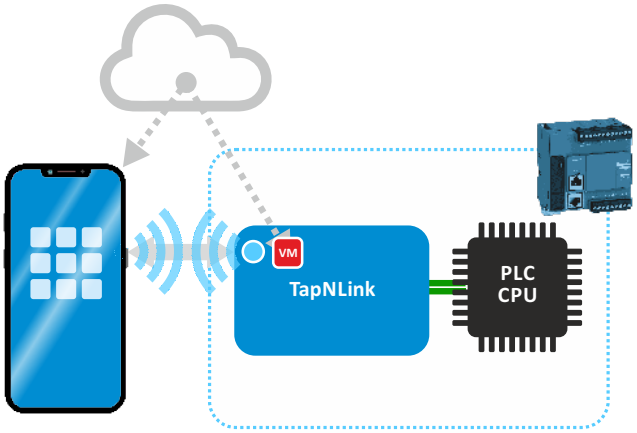
  For wireless retrofit, Tapioca supports a range of fieldbus types: RS232, RS485, USB, Ethernet, CAN. Using the Modbus protocol is an easy and secure way to add this wireless interface. Tapioca manages the Modbus protocol and the user simply configures it with information about the Modbus registers where it retrieves or writes data.



Connect Tapioca directly to the PLC fieldbus (Modbus)

- **Adding a TapNLink module in the PLC design** itself. A central processor (CPU) executes the PLC software. PLC designers can connect TapNLink directly to that CPU using only two of its pins (GPIOs), or a UART port.[1]

  The code that designers add to their CPU software is generated from the TapNLink's configuration. This approach accelerates wireless integration and maximizes reuse of existing hardware and software in their designs.



Connect TapNLink to CPU that drives the PLC

Note 1: For a rapid proof of concept, TapNLink can use the debug port of Cortex-M processors. In this case, there are no changes to the PLC software. However, for added security, it is recommended to use GPIO with S3P protocol, or a UART port.

Mobile HMI for Industrial Equipment

Wireless that connects PLC to mobiles and more

Tapioca adapters provide wireless channels for connecting mobiles to PLC such as **Near Field Communication** (NFC), **Bluetooth** (BLE) or **Wi-Fi**. These channels meet a variety requirements for low-power consumption, range, and bandwidth. IoTize complements these with Wi-Fi or LPWAN (LoRa, LTE, NB-IOT) interfaces to connect PLC directly to networks and cloud supervisory platforms.

NFC for 3-stroke configuration or for device pairing

NFC is greatly appreciated by technicians when connecting mobiles to machines. NFC simplifies the connection process by automatically:

- Initiating the connection by approaching the mobile to the equipment (no codes or addresses to enter),
- Installing the correct app from the appropriate app store,
- Launching the correct app,
- Executing the security and authentication procedures,
- Pairing the mobile's and the machine's Bluetooth or Wi-Fi.

All of this is done automatically and instantaneously, making NFC an excellent complement to Bluetooth and Wi-Fi for ease-of-use and security during on-site interventions.

For on-site data transmission, NFC, Bluetooth and Wi-Fi each fit distinct needs:

- **NFC** is used alone in a mode called **'3-stroke configuration'**. The user (1) taps the mobile to the machine to collect its configuration, (2) modifies it in the app, then (3) taps again to transmit the new configuration to the machine.
  NFC is a great low-cost, low-energy solution for system commissioning, when a machine is not powered. NFC can also operate in **'energy harvesting'** mode. This uses energy from the mobile. The harvested power can even power other components.
- **Bluetooth** offers local connection with low-energy consumption when the user needs to maintain the connection with the equipment (ex. to monitor performance parameters). NFC can be used as a complement for automated and secure pairing.
- **Wi-Fi** allows connection to the internet via a local network, or via the user's mobile phone. It enables features like data logging to a cloud platform and remote alarm monitoring. NFC can be used as a complement to automate and secure the pairing with mobiles.

Wi-Fi

With Bluetooth or Wi-Fi, sensors can maintain a connection with mobiles or the cloud for monitoring.

MOBILE HMI FOR INDUSTRIAL EQUIPMENT

IMPLEMENTING IOTIZE DEVICES

The default values for all of Tapioca's communication protocols and security features are pre-implemented to be operational off-the-shelf. However, **modifying this configuration is a simple process of selecting and setting options**.

Anyone can create their own HMI with our app

With our **Adaptable HMI App**, you can reconfigure Tapioca directly on your mobile phone and create your own HMI to display data or change machine parameters.

Just connect your mobile to Tapioca and configure the display settings for data and parameters in the PLC. You can choose from a large range of graphical objects. You can even send PLC data to a Cloud supervisory platform. The information about the Modbus registers in the PLC is the only thing you need to provide to create your HMI.

Free software environment for greater flexibility

If you need more control of device features or PLC data, our free IoTize Studio software gives you all the control you'll want.

With our Java editor, you can write routines for the device's Virtual Machine (VM). A few lines of Java suffice for storing data as InTap variables, doing conversions, creating comparators and generating alarms. Data can be made available to the mobile app or it can be formatted and sent to any Cloud platform.

IoTize Studio free PC software for wireless device configuration

Create your own mobile app

Do you need to create your own app or have more control of the app graphics? Our Automatic App Generator creates your app based on your configuration. With the click of a button, it provides both a test app (APK or IPA) and an app project.

With that generated project, you can personalize graphics and branding. You have full control of all visual aspects (colors, fonts, images, etc.). You can get the full sources, and adapt your app to meet the most specific or unique cases imaginable.

Apps can be generated for iOS, Android, or for web applications that run on internet browsers.

The generated mobile application can be run locally installed on the mobile, or can be run remotely and accessed by mobiles when an internet connection is available.

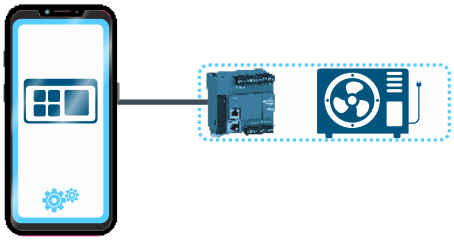
Automatic App Generator to create mobile HMI without coding

Mobile HMI for Industrial Equipment

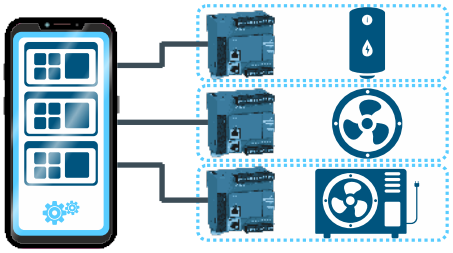
Types of mobile apps

The IoTize solution allows you to create several types of generated apps including:

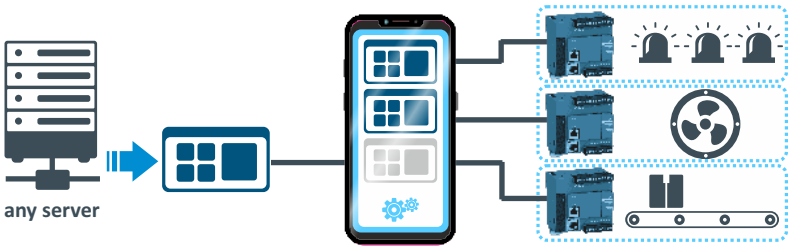
- **Static apps** designed for a single type of machine,



- **Static apps with interfaces for several types of equipment**, where the first exchanges with the app define the type and the correct interface to display,



- **Dynamic apps for different types of machines**, where the first exchanges with the app define the type and the correct interface is retrieved from a server. [2]



Advanced features

Edge computing

IoTize devices have a Virtual Machine which can be used to format data from the PLC. For example, the Java class 'math' is provided to allow any type of calculation. The VM makes it possible to manipulate data locally and display the results in the mobile app, or log the data to a cloud platform.

Alarms and data logging

Similarly, the VM provides JSON or String classes that make it easy to format messages to be sent to a cloud platform when transmitting alarms or storing the history of measured values.

Resources to Get You Started

IoTize provides many examples including sample hardware, device configurations and Java code. These projects demonstrate common implementations of IoTize device features using off-the-shelf electronic devices such as:

- **TapCO2**: Implementation with CO2 / hygrometry rate sensor.
- **TapWatt**: Implementation with an electrical energy metering sensor

Examples available at: **support.iotize.com**

Note 2: Dynamic apps are typically for companies offering configurable equipment like PLCs that may have different uses from one installation to another.

Mobile HMI for Industrial Equipment

Associated Products

Tapioca fieldbus-wireless adapters

Tapioca implements on any equipment that has a serial fieldbus. It allows external access to equipment data and parameters from mobile apps or the cloud.
For PLC, it offers:

- Pre-implemented NFC, Bluetooth (BLE), Wi-Fi, Wi-Fi and LTE-M
- Pre-implemented RS232, RS485, USB, CAN, Ethernet, and Modbus protocol
- No-code integration and smartphone app generation
- Virtual Machine for low-code system design and cloud integration.
- Standard DIN rail or IP67 casings

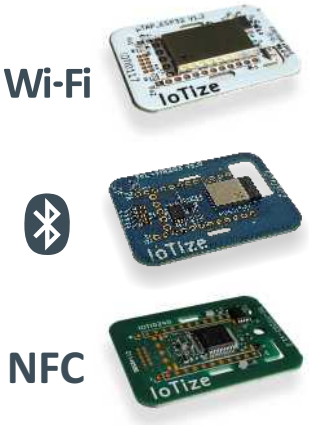
Tapioca fieldbus-wireless adapters

Tapioca products online: **iotize.com/tapioca**

TapNLink wireless modules

TapNLink integrates fully into any electronic design allowing connections to mobiles or the cloud. It connects to microcontrollers to allow external access to system data, or can be used as the system's CPU and drive external components. For PLC, it offers:

- Pre-implemented NFC, Bluetooth (BLE) and Wi-Fi
- Dynamic, per-session encryption and configurable access control
- No-code integration and smartphone app generation
- Virtual Machine for low-code system design and cloud integration.



TapNLink wireless modules

TapNLink products online: **iotize.com/tapnlink**

Software Ecosystem

All IoTize wireless devices are based on our embedded Duetware which pre-implements the features required for any connected device (communication protocols, security, data handling, etc). Devices benefit from a complete software ecosystem that includes:

Free device configuration environment

IoTize Studio provides a single, free PC **software environment for configuring all pre-implemented features**, writing Java code and managing other software tools.

Automatic App Generator

Our server-based tool **automatically generates graphical interfaces as iOS and Android apps**. It outputs test apps, and app projects for creating your final publishable app. It provides a wide range of display elements including buttons graphs, sliders, charts, and more. Advanced users can create static and dynamic multi-target apps. No expertise in app development and no coding are required.

For more information visit: **iotize-apps.com**

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