HEXIWEAR
COMPLETE IOT DEVELOPMENT SOLUTION

NXP SEMICONDUCTORS
THE ONLY SUPPLIER TO PROVIDE COMPLETE IoT SOLUTIONS

- DSPs, MCUs & CPUs
- Suite of Sensors
- NFC, BLE, Thread, zigbee, sub-GHz Wireless Interconnects
- Power Management
- Complete HW/SW Security Suite
- IoT System Solutions
Product Development Challenges

Even in the modern connected world, product development challenges still exist...

- Time to market
- Development and production costs
- Going from prototype to production

Although the market requirements have changed, the product development process has not changed in the last several years...
Introducing Hexiwear
Complete IoT Development Solution

Completely open source – a foundation for your inventions
Hexiwear Overview

NXP partnered with MikroElektronika to create a complete development solution that enables quick and easy application development for the IoT market.

**Highlights**

- Optimized hardware with compact form factor
- Designed for IoT end node applications with onboard sensors such as temperature, pressure, humidity and light
- Ideal for wearable applications with rechargeable battery, OLED screen and sensors such as optical heart rate, accelerometer magnetometer and gyroscope
- Complete software solution with open source embedded software, cell phone apps and cloud connectivity
- Infinitely expandable with the ecosystem of ~200+ Click Modules

Small form factor, low cost ($49 resale), modular hardware development platform, based on Kinetis MCU, with wireless connectivity and sensors. Comes supported with a development software package, user application demos, mobile app and cloud connectivity.
Hexiwear Value Proposition

- **Fastest Time to Market**
  Versatile solution created to reduce development and design time for IoT applications

- **Path to Manufacturing**
  Designed to accelerate the customer’s time to manufacturing. The BOM is readily available in the market and the design files/schematic is open source.

- **Optimized Hardware Design**
  The hardware design is optimized and includes several best practices suggested for designing low power IoT applications

- **Robust Software**
  The software includes everything from the embedded drivers to the cloud connectivity - all open source, easy to use and optimized

- **Community Supported**
  Hexiwear is a true community based solution and enables customers to access the rich pool of resources created by community
Hardware Overview
Hexiwear Block Diagram

MK64FN1M0VDC12
- ARM® Cortex®-M4 up to 120MHz
- 1MB Flash and 256KB RAM
- UART, SPI, I2C, USB communications
- Sensor (6) Connection (2* I²C)
- RGB and Vibration motor (4* GPIO)
- External interfaces (dock station)
  - UART (2), SPI (1), I²C (1), PWM (3), AN (3), GPIO (6)
  - SDHC and I2S

MKW40Z160VHT4
- ARM® Cortex®-M0+ up to 48MHz
- 160KB Flash and 20KB RAM
- 2.4 GHz transceiver compatible
- Bluetooth® Low Energy v4.1 and 802.15.4
- Capacitive Touch (6 electrodes)
- UART and SPI communications
Hexiwear Sensors

**HTU21D**
- fully-calibrated Humidity Sensor
- +/-3%RH tolerance @55%RH
- fully-calibrated Temperature Sensor
- ±0.3°C accuracy from -40 to +125°C
- Consumption: down to 450µA in active mode
- I2C digital interface: up to 400kHz dual-mode

**TSL2561**
- Light to digital converter
- 0.1 to 40,000 Lux dynamic range inc. both infrared and full spectrum diodes
- Consumption: down to 240µA in active mode
- I2C digital interface: up to 400kHz

**MAX30101**
- Pulse Oximeter and Hear Rate Sensor
- high sensitivity with 16-bit ADC
- Consumption: down to 600µA in dual active mode
- I2C digital interface: up to 400kHz

**FXOS8700CQ**
- 3-axis linear accelerometer
- ±2 g/±4 g/±8 g dynamic range
- 3-axis magnetometer
- ±1200 µT range
- Low-Power consumption: down to 80µA with both sensor active
- I2C digital interface: up to 400Hz dual, 800Hz single-mode

**FXAS21002CQ**
- 3-axis gyroscope
- ±250/500/1000/2000°/s dynamic range
- Consumption: down to 2.7mA in active mode
- I2C digital interface: up to 800Hz

**MPL3115A2**
- Absolute pressure sensor
- calibrated 50kPa to 110kPa range
- altitude accuracy down to 0.1m
- Consumption: down to 8.5µA (capt.) max 2mA (with conv.)
- Autonomous data-logging: 32-sample FIFO up to 12 days
- I2C digital interface: up to 400Hz
Hexiwear Docking Station

- The Docking Station, compatible with Hexiwear, is used to debug **Kinetis K64** and **Kinetis KW40** MCUs.

- The Docking Station can connect up to 3 external Click Modules out of ~200 available.
Software Overview
Hexiwear Software Ecosystem

Complete open source software package including the source code for embedded software, application examples, Android and iOS apps and out of the box cloud connectivity

**Embedded software**
- Running FreeRTOS as an embedded operating system
- Application examples with IoT and wearable application use cases
- Drivers based on Kinetis SDK
- OpenSDA as a serial and debug adapter
- BLE communication is based on Kinetis Connectivity Software (available in binary)
- Software available at [www.Hexiwear.com](http://www.Hexiwear.com)

**Cell phone app**
- Android app available [HERE](http://HERE) and iOS App is available [HERE](http://HERE)

**Cloud connectivity**
- Cloud connectivity integrated in Android and iOS apps
Hexiwear Visualize data

- Set the time on Hexiwear
- Perform OTAP update
- Select which data sensor you want to see

- Send data to WolkSense Cloud
- Select iteration you want to upload data to cloud

Visualize the sensor data from Hexiwear device
Hexiwear GitHub

MikroElektronika / HEXIWEAR

- 78 commits
- 1 branch
- 0 releases
- 6 contributors

Hexiwear firmware: http://www.hexiwear.com

Latest commit 1ca891a 27 days ago
- BluesPower MIC24045 example added
- HW: Updated programming steps in maintenance mode.
- SW: MIC24045 example added
- documentation: Added guide for setting up toolchain for developing firmware for KW40...
- README.md: GSM4 library added

NXP
Use Cases

HEXIWEAR
Hexiwear IoT End Node

Sensor Tag

Internet of Things "node" or "thing", broadcasts sensor data (Broadcasting sensor readings over BLE, Wi-Fi or USB CDC, out of the box support for on-board sensors)
Hexiwear IoT End Node

IoT End Node developed rapidly with KSDK or FreeRTOS

Internet connected Wi-Fi Router

Cloud Connectivity provides a scalable foundation for cloud apps connecting to IoT End Node
Hexiwear Wearable Use Case

**Smart Watch**
- Cell phone notification alert
- Data transferred to cellphone app
- Offline data storage in serial flash

**Health/Fitness Band**
- Pedometer
- Calories burned
- Heart rate and pulse oximetry monitoring
Hexiwear Wearable Use Case

Low power wearables / sensor tag developed rapidly with KSDK or FreeRTOS

Internet connected using a mobile device (Android, iOS)

Cloud connectivity provides a scalable foundation for cloud apps connecting to wearables / sensor tag
Infinitely Expandable

HEXIWEAR
Hexiwear Infinitely Expandable

- Compatible docking station
  Where you can use up to 3 expansion modules

- ~200 plug and play add-on sensor boards
  Currently available which comes with example code to get you started in minutes

More information is available [here](#)

- Designed for expansion with easy access to SPI, I2C and other serial interfaces for customization
  Supported by MikroBUS standard expansion port
Hexiwear
Infinitely Expandable

Leverage and build upon
~200 expansion modules
### Hexiwear Infinitely Expandable

<table>
<thead>
<tr>
<th>Smart Multimedia</th>
<th>Smart Home</th>
<th>Smart World</th>
<th>Smart Interface</th>
<th>Smart Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buzz Click</td>
<td>Wifi 3 Click</td>
<td>Thunder Click</td>
<td>Relay Click</td>
<td>Optical Heart Rate Monitoring</td>
</tr>
<tr>
<td>MP3 Click</td>
<td>Motion Click</td>
<td>UV Click</td>
<td>NXP NFC Chip</td>
<td>Calorie and Step count</td>
</tr>
<tr>
<td>Camera Click</td>
<td>Flame Click</td>
<td>Hydrogen Click</td>
<td>Proto Click</td>
<td>Alcohol Click</td>
</tr>
<tr>
<td>IR Gesture Click</td>
<td>Air Quality Click</td>
<td>Methane Click</td>
<td>4x10 RGB Click</td>
<td>IRThermo Click</td>
</tr>
</tbody>
</table>
Hexiwear Next Gen IoT Solution for Innovators

Value Proposition

**Fastest Time to Market**
Versatile solution created to reduce development and design time for IoT applications

**Path to Manufacturing**
Designed to accelerate the customer’s time to manufacturing. The BOM is readily available in the market and the design files/schematic is open source.

**Optimized Hardware Design**
The hardware design is optimized and includes several best practices suggested for designing low power IoT applications.

**Robust Software**
The software includes everything from the embedded drivers to the cloud connectivity - all open source, easy to use and optimized.

**Community Supported**
Hexiwear is a true community based solution and enables customers to access the rich pool of resources created by community.

Key Components

**Total NXP BOM**
$16 - 7 NXP components: MCUs, connectivity, sensors and battery charger - Kinetis K64 MCU based on ARM Cortex-M4 core

**Kinetis KW40Z multimode BLE and 802.15.4 radio SoC**

**Color OLED Display, Rechargeable battery, External flash**

**Design Resources Available**

**Software**
Schematic, Design Files, Bill of Material (BOM)
iOS and Android App

**Software Development Environment**

Kinetis SDK *(Open-source and Free)*
Kinetis Design Studio *(Open-source and Free)*
FreeRTOS *(Open-source and Free)*

Target Applications

IoT end nodes & Wearables
NXP

SECURE CONNECTIONS FOR A SMARter WORLD