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Smartplug Application Development Kit

PRODUCT OVERVIEW

The GainSpan Smartplug Application Development Kit (ADK) is a complete smartplug reference design based on the GS2100MIP Wi-Fi module and associated embedded and mobile software suite. The Smartplug ADK allows users to add Wi-Fi connectivity to a single socket 100-265V plug and control electrical load using a web browser or a smartphone. Integrated Sigma-Delta ADC on the GS2000 SoC is used for power measurements. The ADK provides a complete suite of embedded and mobile reference applications to greatly ease, and shorten development time.

The Smartplug application consists of two functions:

- Load control to turn load on/off
- Power measurement to measure the following parameters: voltage, current, frequency, instantaneous power, energy and power factor

The GainSpan Smartplug ADK includes the smartplug hardware, a complete hardware design package, embedded software running on the GainSpan Wi-Fi module, web application and mobile reference applications for iOS and Android based smartphones. An evaluation version of the ADK, the Smartplug Application Evaluation Kit (AEK) is also available that will include the smartplug hardware and binary-only software.

OPERATIONAL MODES

The GainSpan Smartplug may perform as a limited access point (Limited AP mode) or as a client within an existing network infrastructure (Client/Station mode).

In Limited AP mode, the smartplug has a webserver running on the Wi-Fi module and can create connections with multiple clients. Once the smartphone has established connection with the smartplug, the smartplug app discovers and selects a smartplug service profile being advertised by the smartplug and selects it to enable load control and display of electrical parameters.

In Client/Station mode, the smartplug and the smartphone connect to an AP as clients. The smartphone now discovers the smartplug profile, and upon selection, displays the electrical parameters and allows load control. In this mode, the Wi-Fi module runs both a webserver and a web client and allows direct control with a smartphone within the home network, as well as connecting and sending updates to the cloud. The Client/Station mode supports the IEEE PS-Polling mode and is suitable for low-power applications.

Both the Limited AP mode and client/station modes provide mDNS/DNS-SD based discovery methods. The embedded application advertises availability, and clients automatically discover the smartplug profile and connect to it. Discovery allows clients to locate and connect to smartplug without the need to know the URL.

Provisioning of the GainSpan node in Limited AP or Client/Station modes and Over-the-air firmware updates (OTAFU) of the GS2100MIP module firmware can be done using Provisioning and OTAFU web or mobile applications.

BENEFITS:

- **Complete Smartplug reference design to control electrical load and monitor and chart electrical parameters (voltage, current, power, frequency, power factor) using a web browser or mobile smartphones**

- **Integrated 16-bit Sigma-Delta ADC reduces BOM by eliminating the need for an external power measurement chip**

- **Target applications are smart plugs and smart power strips**

- **Accelerated time-to-market using GainSpan's solution that includes complete hardware design package and software suite (embedded software source and mobile reference apps)**

FEATURES:

- **Smartplug ADK hardware features**
  - **Standard socket, single-phase 100-245V, 10A plug**
  - **GainSpan GS2100MIP Wi-Fi module**
  - **Integrated power measurements using the on-chip 16-bit Sigma Delta ADC**

- **Smartplug ADK software features**
  - **Complete networking and Wi-Fi stack**
  - **Complete suite of security protocols, including WPA/WPA2, legacy WEP, and upper layer security protocols such as TLS/SS and HTTPs**
  - **Automatic discovery by clients using mDNS/DNS-SD discovery methods**
  - **Web and iOS/Android mobile apps allow load control and power measurement and show time-series graphs of historical values collected during a session**
  - **Cloud connectivity to Exosite cloud**
  - **Works with the GainSpan HEMS application**

- **Planned support for**
  - **SEP 2.0 profile support**
 - **Zigbee IP 802.15.4 support**

GAINSPAN SMARTPLUG ADK SOFTWARE

The GainSpan SmartPlug ADK software allows an electrical load to be turned on or off and represents the state of the following variables:

- Power Measurement
  - o Voltage
  - o Current
  - o Frequency
  - o Power
  - o Energy
- Load control (load)
  - o State – on/off

The Smartplug embedded firmware application including an HTTP server, runs on the GainSpan Wi-Fi module and responds to HTTP POST/GET requests initiated by a browser or a smartphone-based native application. Both the web and native applications are based on a RESTful architecture and communicate with the HTTP server using GET/POST methods and XML syntax. The embedded software advertises the SmartPlug application profile, allowing automatic discovery by client applications using mDNS/DNS-SD (Bonjour) discovery methods. The mobile and web applications leverage discovery and the RESTful HTTP API exposed by the smartplug embedded application to fetch the state of smartplug variables or turn load on/off.

SMARTPLUG MOBILE APPLICATION (ANDROID)

GS2K-SMTPLG-ADK-PB-00111
Release 0.1
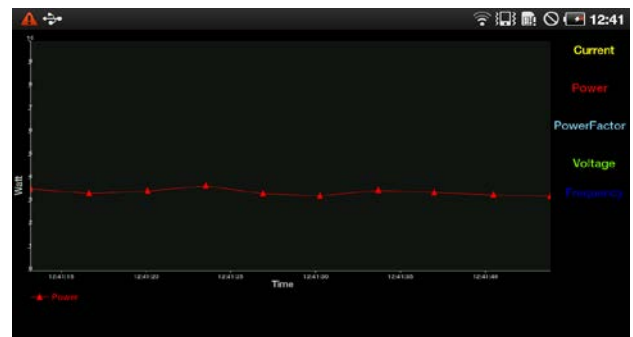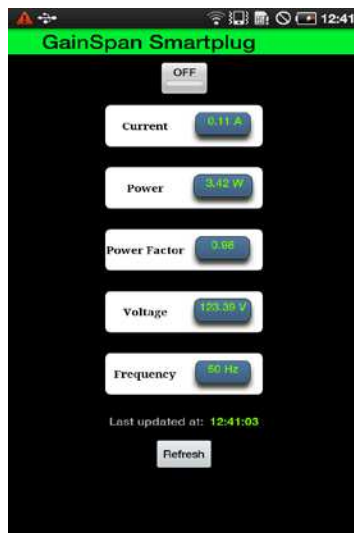
SMARTPLUG MOBILE APPLICATION (iOS)
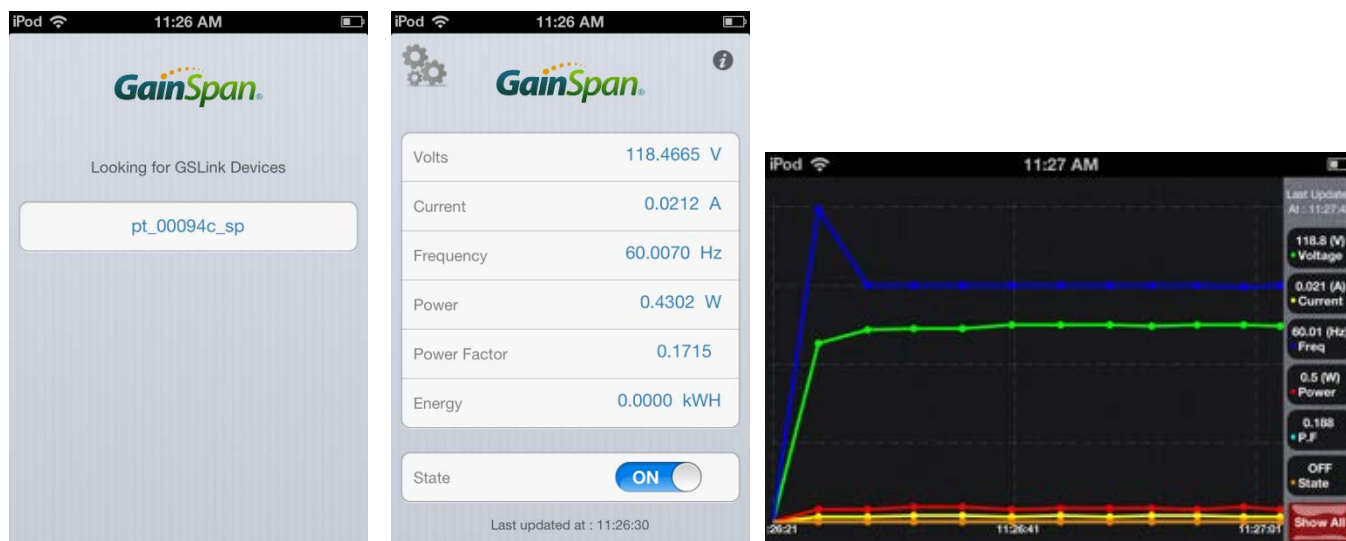
The Smartplug ADK works with the GainSpan Home Energy Management System (HEMS) ADK, which can be used to control multiple smartplugs and thermostats on the home network. The HEMS app allows selection and control of multiple devices, either one-at-a-time or all-together. Once device is selected, the app allows load on/off control as well as a graphical display of the power measurements.

GAINSPAN SMARTPLUG HARDWARE DESCRIPTION

The GainSpan Smartplug ADK features a standard socket, single-phase 100-265V, 10A smartplug based on the GainSpan GS2100M Wi-Fi module. Sigma-Delta ADCs on the GS2000 SoC are used to measure voltage and current.

Components	Description
GainSpan Wi-Fi Module	GS2100MIP module turns load on/off
Power Relay	Relay to turn load on/off
Power Supply Unit	Provides power to GainSpan Wi-Fi module
Switches and Buttons	Power, Manual Load Control button, WPS, Program/Run and Restore Backup Firmware
LEDs	Indicates Power On, Operation mode (Limited AP or Client) and Run/Program mode
USB port	Used to power the board and upgrade firmware on the Wi-Fi module

HIGH VOLTAGE WARNING!!

The GND symbol on the schematics included in the ADK and AEK are NOT earth ground and are NOT safe to touch. The metal shield on the GainSpan module is NOT safe to touch. These are both connected to the AC Neutral power input. Touching this can cause severe electrical shock, resulting in serious injury or death. DO NOT connect test equipment grounds to the internal GND. The USB voltage is isolated from the high voltage, and is safe to connect to a computer.

SMARTPLUG ADK AND AEK CONTENTS

Components	ADK	AEK
Smartplug Embedded Firmware Application	Binary and Source	Binary Only
Smartplug Mobile Application for iOS/Android Smartphones	Mobile Application and Source	Mobile Application
GainSpan Smartplug	Hardware	Hardware
USB Cable	Hardware	Hardware

SMARTPLUG ADK/AEK ORDERING INFORMATION

ITEM	PART NUMBER	Description
GainSpan Smartplug ADK	GS-ADK-Smartplug2000	GainSpan Smartplug ADK based on GS2100M Wi-Fi modules
GainSpan Smartplug AEK	GS-AEK-Smartplub2000	GainSpan Smartplug AEK based on GS2100M Wi-Fi modules