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Engineering Smartness



## Universal Communication Module for Smart Grid

Research institute for Energy developed the new Demand-response protocol (CEA-2045) for Home appliances. The UCM can bridge the Home appliance to many demand-response protocols. The reference device bridged between OpenADR and CEA 2045.

**Project Duration:** 7 months

**Technology Used:** OpenADR, CEA-2045, SSL/TLS, Linux, C++, u-boot, AR9342, RS-485

### Challenge

- Create a bridging device between CEA-2045 and OpenADR protocols
- Resource optimization for limited flash storage and developing USB to SPI bridge in microcontroller

### Outcome

- Developed an ultra low cost UCM with WiFi uplink overcoming tight resource constraints.
- Developed OpenADR to CEA-2045 Mapping Software in C++ on OpenWRT.
- Support for automatic firmware update.

WHAT DID GADGEON DO?	PLATFORMS/ TECHNOLOGIES USED
1) Software Architecture for complete system	Requirements Gathering & Analysis, Uses cases, Architecture development, identification of functional components.
2) Firmware	<p>The mandatory interfaces of RS485 and CEA-2045 SPI is added to the Kernel. The device model for the board init file is created for the UCM.</p> <p>The custom SPI interface is connected to the GPIOs available. These GPIO lines is incorporated in to the Datalink state machine in the application space for bit-banging.</p> <p>The Linux kernel SPI framework is used to register a new SPI slave. The datalink state machine is incorporated in the Kernel module for the CEA-2045 compliant SPI.</p> <p>WiFi interface support Station and AP modes using virtual interfaces</p> <p>User interface developed using LuCi framework in OpenWRT. Bridging software developed in C++ and threads.</p> <p>Developed USB to SPI bridge using MSP430 Microcontroller.</p> <p>Logging &amp; Reporting Software</p>





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