1.1 Functional Decomposition Level 0 - Vehicle System

Module	Onboard Vehicle Power System
Inputs	Wireless energy from charging pads Battery voltage levels
Outputs	RFID signal DC power to battery
Functionality	The onboard system takes in battery voltage levels to determine if the battery needs to acquire power from the road. Based on this information, different codes are transmitted by the vehicle RFID tag in order to request power when needed. The onboard system then receives power transmitted by the charge pads in the Road Surface Power System. Finally, the onboard vehicle power system outputs the received power to the vehicle battery for charging.

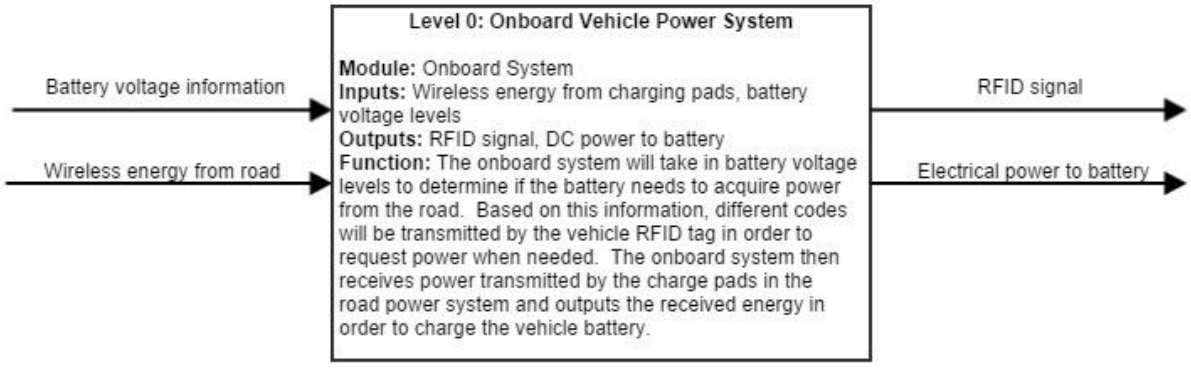

Fig. 1: Level 0 Functional Decomposition for Onboard Vehicle Power System

1.2 Functional Decomposition Level 0 – Road System

Module	Road Surface Power System
Inputs	RFID signal 60Hz/120V electrical power
Outputs	ISM-band wireless power Power metering information
Functionality	The road surface power system is powered by mains power from the electrical grid. An RFID reader and control subsystem determines if power should be transmitted based on the input RFID signal. Additionally, based on RFID readings, only the road-surface level charge pads nearest the vehicle enter transmit mode, outputting wireless power in an ISM band. The road system also meters power used by each vehicle and stores the information in a database to be accessed on the web by users (vehicle drivers) or power companies.

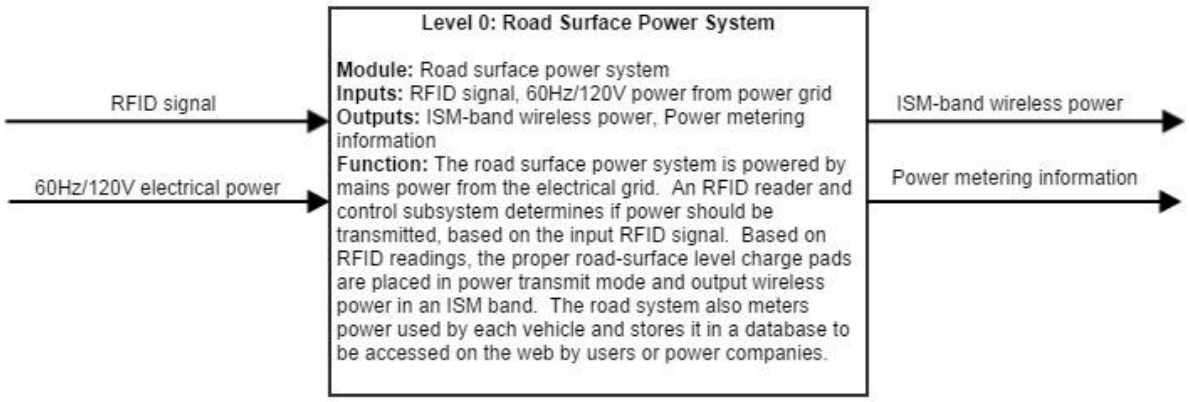

Fig. 2: Level 0 Functional Decomposition for Road Surface Power System

2.1 Functional Decomposition Level 1 - Vehicle System

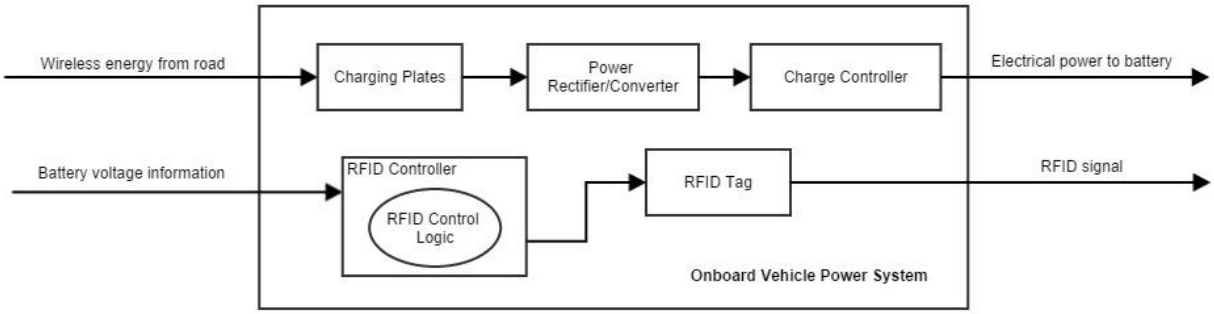

Fig. 3: Level 1 Functional Decomposition for Onboard Vehicle Power System

Module	Vehicle Capacitive Plate Module
Inputs	Wireless power from road capacitive plates
Outputs	Power over a wire to the Rectifier-Converter Module
Functionality	Receives power through capacitive coupling with the road Capacitive Plates Module and feeds AC power to the Power Rectifier/Converter Module

Module	Rectifier-Converter Module
Inputs	Electrical power from vehicle Capacitive Plate Module
Outputs	Rectified electrical power to vehicle Charge Controller
Functionality	Converts electrical power from the capacitive plates to a current and voltage that can be used by the charge controller

Module	RFID Controller
Inputs	Battery state information
Outputs	Control to the Active RFID Tag in the vehicle
Functionality	Sends data to the RFID Tag in the vehicle. These data determine if the vehicle needs power from the road.

Module	Vehicle RFID Tag
Inputs	Data from RFID Controller
Outputs	Wireless signal to the road RFID Reader
Functionality	Transmits the data from the RFID Controller to the RFID Reader in the road.

Module	Charge Controller
Inputs	Electrical power from the Rectifier-Converter Module
Outputs	Electrical power to the battery
Functionality	Charge the vehicle battery.

2.2 Functional Decomposition Level 1 - Road System

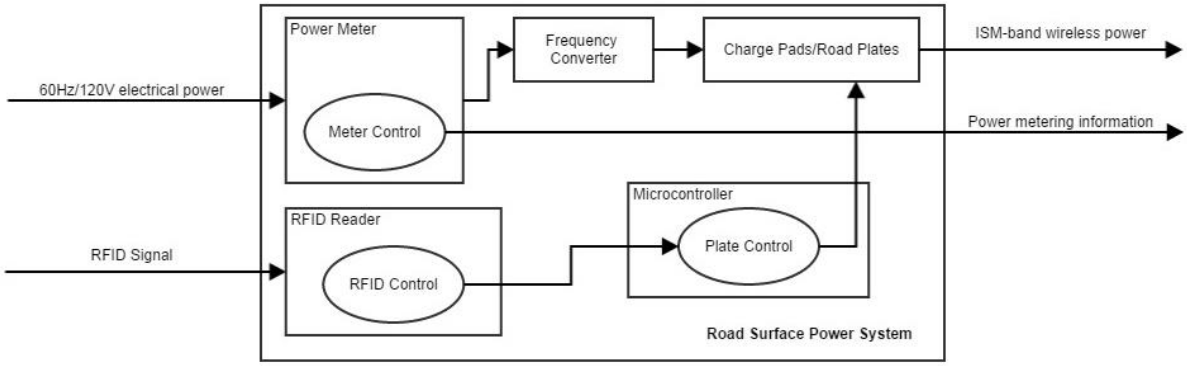

Fig. 4: Level 1 Functional Decomposition for Road System

Module	Power Meter
Inputs	Mains power from the power grid and data from RFID Reader
Outputs	AC mains electrical power to the Frequency Converter and meter information to a database
Functionality	Reads the amount of power going into the system from the power grid and provides information associating each vehicle with its power usage. This allows power companies to bill the corresponding users (vehicle drivers) for their power consumption.

Module	Frequency Converter
Inputs	120V 60Hz AC power from the power meter
Outputs	Frequency converted signal to Capacitive Road Plates
Functionality	Changes the frequency from 60Hz to an ISM transmission frequency.

Module	Capacitive Road Plates
Inputs	Frequency converted power source Control signals from plate Control Module
Outputs	Wireless ISM-band frequency converted power signal and metering information
Functionality	Enables conversion from a wired power signal to a wirelessly transmitted power signal. There are multiple of these modules that are individually activated or deactivated by the Control Module.

Module	RFID Reader
Inputs	RFID signal from RFID Tag in vehicle
Outputs	Data to Control Module in road and data to Metering Module
Functionality	Reads vehicle RFID tag and sends identification information to Control Module and Metering Module

Module	Control Module
Inputs	RFID Reader data
Outputs	On/Off selection signal to control Capacitive Road Plates
Functionality	This module controls the Capacitive Road Plates. It first determines which individual capacitive plates to activate based on RFID data from the RFID Reader, then activates the correct plates.