

# LOW ENERGY WI-FI® COMMUNICATIONS FOR THE IOT IN A WIDE AREA

 TECNOLOGÍA PATENTADA

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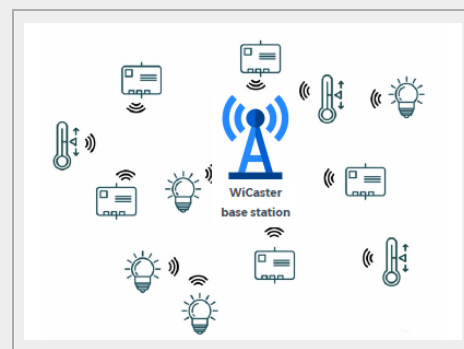
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## RESUMEN

The invention consists in a communications system to send/receive data blocks (700 bytes maximum) between a base station and a set of Wi-Fi® sensors without any active data link (active Wi-Fi® network connection). A base station has a coverage area between 12 km<sup>2</sup> and 30 km<sup>2</sup> without obstacles.

The system provides broadcasting and unicasting communication modes. It's the most efficient solution for unidirectional communication of the sensors to a base station. It reduces the power consumption of Wi-Fi® chipsets (does not require an active Wi-Fi® connection) and provides more security because it's immune to the DoS attacks on Wi-Fi® WPA2 chipsets.

The technology can be used in applications for the Internet of Things (IoT) in order to interchange data between sensors and Internet using a single Internet connection in the base station.



## INTRODUCCIÓN

Nowadays, there are several technologies to solve communication problems between IoT sensors and Internet. These technologies are mainly:

- a) Low power and wide area solutions (LoRaWAN, SigFox, NBLoT, LTE-M) with expensive network interfaces for sensors.
- b) Wi-Fi® solutions using low cost network for sensor data transmission, but with high power consumption and low range distance (100 meters).

The invented technology improves Wi-Fi® communications for the IoT, increasing range distance and reducing energy consumption using standar Wi-Fi® chipsets.

## DESCRIPCIÓN TÉCNICA



The technology has developed a software method to send/receive data between a base station and sensors using standar Wi-Fi® chipsets. The Wi-Fi® interfaces do not need any connection to standard Access Points (APs) nor IP addresses.

The system consists in two elements:

- A base station with two interfaces:
  - o One Wi-Fi® interface to send/receive data to/from sensors in a wide area.
  - o One Internet connection interface (Ethernet/UMTS) to interchange data between sensors and any IP address in Internet.
- Software installed in sensors to use Wi-Fi® chipsets to send/receive data to/from a base station without any active data link.

## VENTAJAS Y ASPECTOS INNOVADORES

### MAIN ADVANTAGES OF THE TECHNOLOGY

The technology provides a set of advantages to improve limitations of communications between Wi-Fi® sensors and Internet:

- Reduces the power consumption of Wi-Fi® sensors when sending/receiving data.
- Increases the coverage area for a Wi-Fi® communication from 100 meters until 3 kilometers, according to the prototype used.
- Reduces the infrastructure costs, substituting multiple Wi-Fi® access points for a single base station.
- Reduces the economic costs of the Internet connectivity of the sensors. It uses a single Internet connectivity at the base station, therefore, it not exist an economic cost associated with each sensor.
- Immunity to WPA2 Wi-Fi® DoS (Denial of Service) attacks of authentication, allowing the use of WPA2 chipsets with total security.
- Communications encryption using pre-installed 128-bit AES keys.
- Compatibility with Wi-Fi® 802.11ah (Wi-Fi® HaLow) chipsets that allow greater carrier range in the ISM 900 MHz band.

### INNOVATIVE ASPECTS

The main innovations are the reduction of power consumption and the increase in coverage area for Wi-Fi® sensors in the Internet of the Things (IoT) applications, using the Wi-Fi® WPA2 chipsets already on the market.



The technology is developed and there is a prototype based on base station and network of temperature and humidity sensors with Wi-Fi® 802.11b chipset. The prototype has been evaluated in field tests.

#### APLICACIONES DE LA OFERTA

The technology can be applied in IoT solutions where there is the need to use low power and wide area Wi-Fi® communications with sensors. For example:

- Sensor deployments for agriculture applications (smart farms).
- Sensor deployments for big infrastructures (stadiums, bridges, sea ports, etc.)
- Sensor deployments in areas with no coverage of mobile data service (GSM/UMTS) like forests, high mountain or sea.

#### COLABORACIÓN BUSCADA

Researchers are looking for companies acquiring the technology for implementation in their products. It is possible to reach license agreements.

#### DERECHOS DE PROPIEDAD INTELECTUAL

This technology is protected by **patent granted**:

- Title of the patent: "DISPOSITIVO EMISOR, DISPOSITIVO RECEPTOR, SISTEMA DE DIFUSIÓN Y PROCEDIMIENTO DE DIFUSIÓN DE INFORMACIÓN DESDE UN DISPOSITIVO EMISOR A UN NÚMERO ILIMITADO DE DISPOSITIVOS RECEPTORES".
- Application number: P201630175
- Application date: 16/02/2016

#### SECTORES DE APLICACIÓN (5)

Agri-food and Fisheries  
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