



# Pysäköid.ai

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## Etymology

pysäköidä (Finnish word for parking) + AI



# Vision

We envision an autonomous parking facility for vehicle, where all processes required for daily operations are fully automated without the need for human assistance, while having a low carbon footprint.



## Components (05)

- Parking Slot Allocation
- Energy-Based Payment
- Adaptive HVAC + Lighting
- Automated Cleaning and Waste Disposal
- Automatic Fault Detection



# Skenaario

## On the surface

1. Drive-in
2. Receive parking spot
3. Get directions
4. Plug car to micro-grid
5. Do “stuff”
6. Come back to car, and leave

## Behind the Scenes

1. Fleet management
2. HVAC + Lighting adapt to utilization
3. Draws energy from cars depending on time
4. Automatically decides areas to clean
5. Report a fault in case of malfunction



# Sustainability

- Less fuel wasted while looking for a parking spot
- No energy wasted in energy transport from local power plant to facility
- “Remove the human”

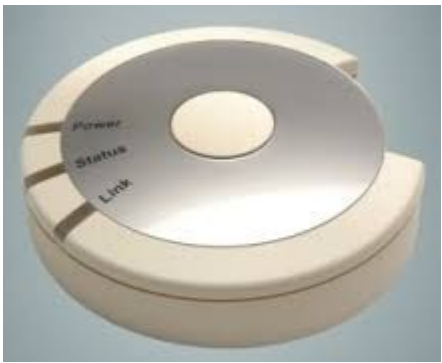
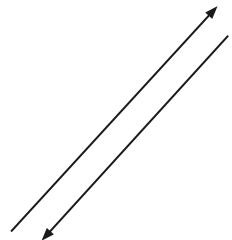


## Benefits and savings

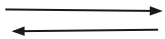
- Reduced parking time (~11s in a flat parking area)
- Reduced fuel consumption (proportional to time saved)
- Energy and cost saving through HVAC automation
- Enhanced user experience
- Micro-grid



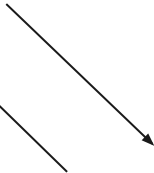
# Prototype



HMLAN



Car Display



Car Park Sensor



Parking Facility



Server





## Experience with platform

- Pairing devices can be troublesome
  - Display device crashed the server (possible firmware issue)
- LED display uses hex (obvious but overlooked)
- Reaching the Duty Life Cycle limit (868Mhz)
  - Crashing the LED screen transmission quota of 36s per hour
- Lack of proper documentation for the devices

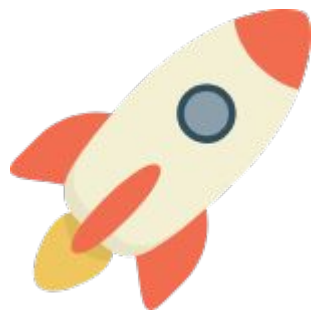


## Cool code

- Efficient rendering using Hex
- Simulation for random arrivals and departures
- Modular and reusable



# Demo





# Impressions of FHEM

- Who uses PERL?
- Ich spreche kein Deutsch
- ACK Missing, Nack, Err no: 0, “help me!!!”
- Feels awkward at first, even to do the most basic things
- User-unfriendly



## Next Steps (aka not gonna happen)

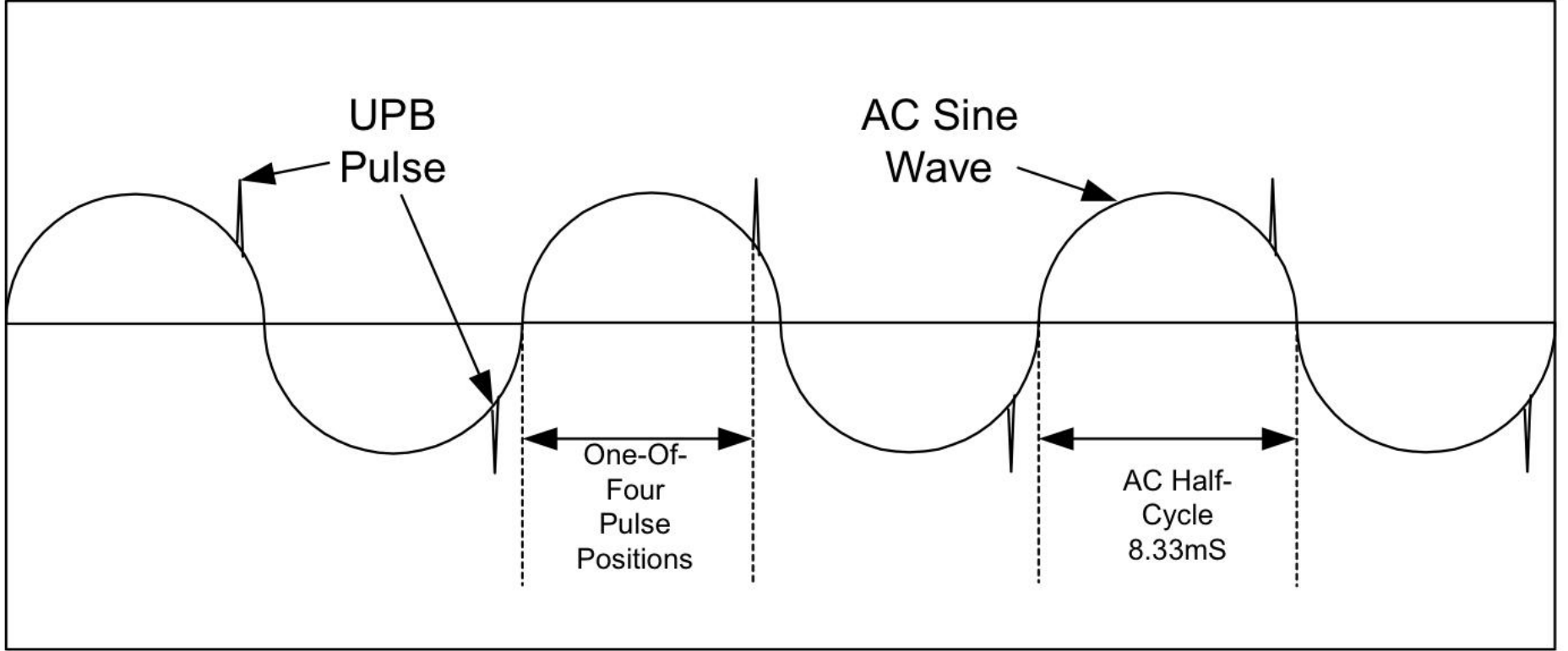
- Multiple optic sensors (for multiple parking spots)
- Display energy bill when leaving
- Figure how to do spaces in the display
- Integrate with actual car navigation system
- Location awareness

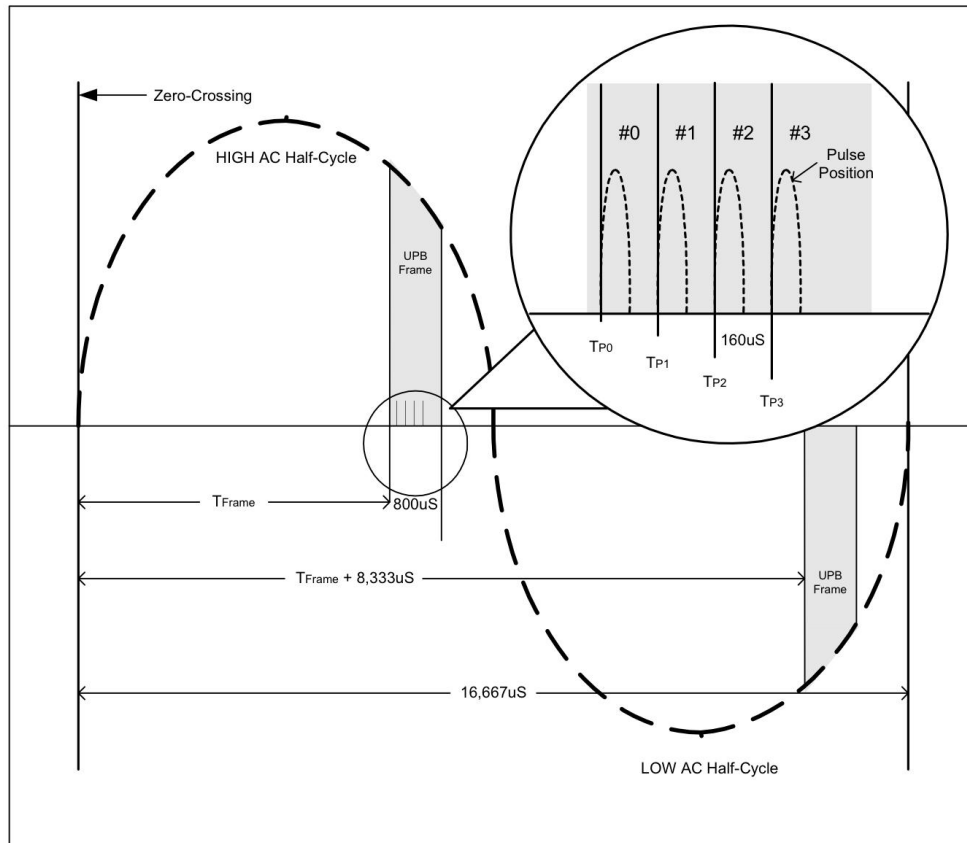


# IoT Communication Protocol: UPB

- Universal Powerline Bus
- Uses powerline wiring for signaling and control
- Developed by PCS
- Released in 1999
- Based on concept of X10 standard
  - Improved transmission rate
  - Higher reliability

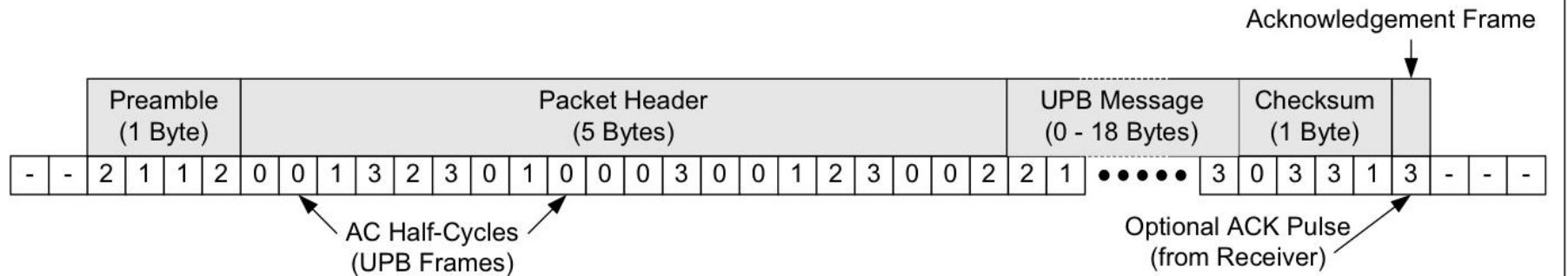
Reference: UPB Technology Description, ver. 1.4, PCS, 2002.



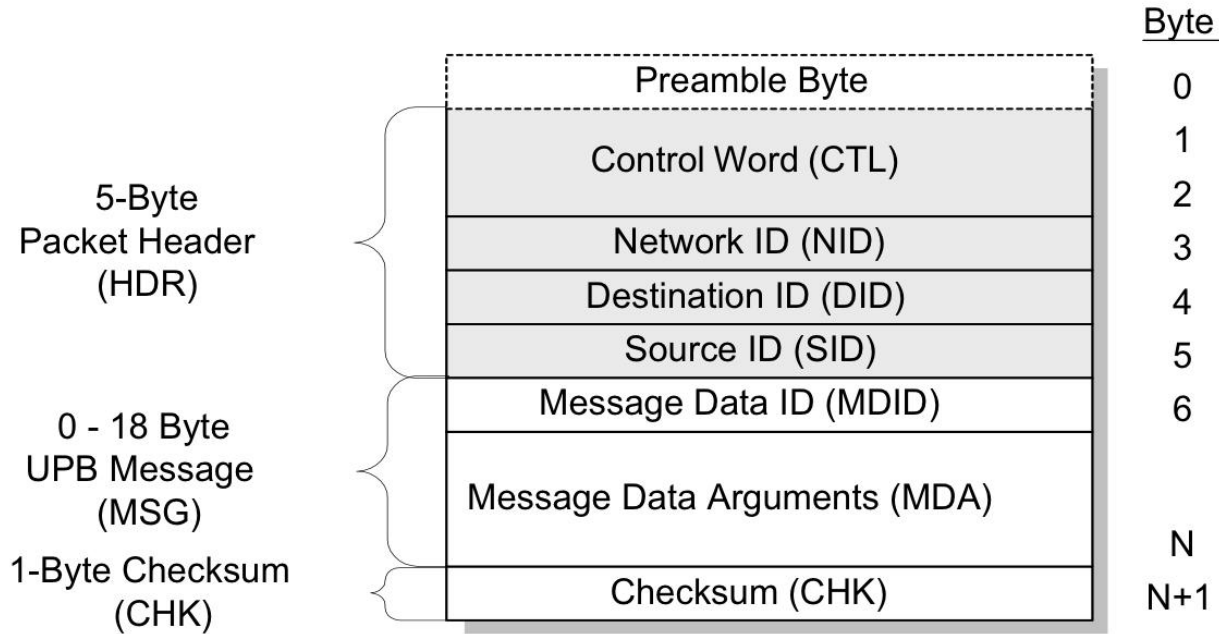




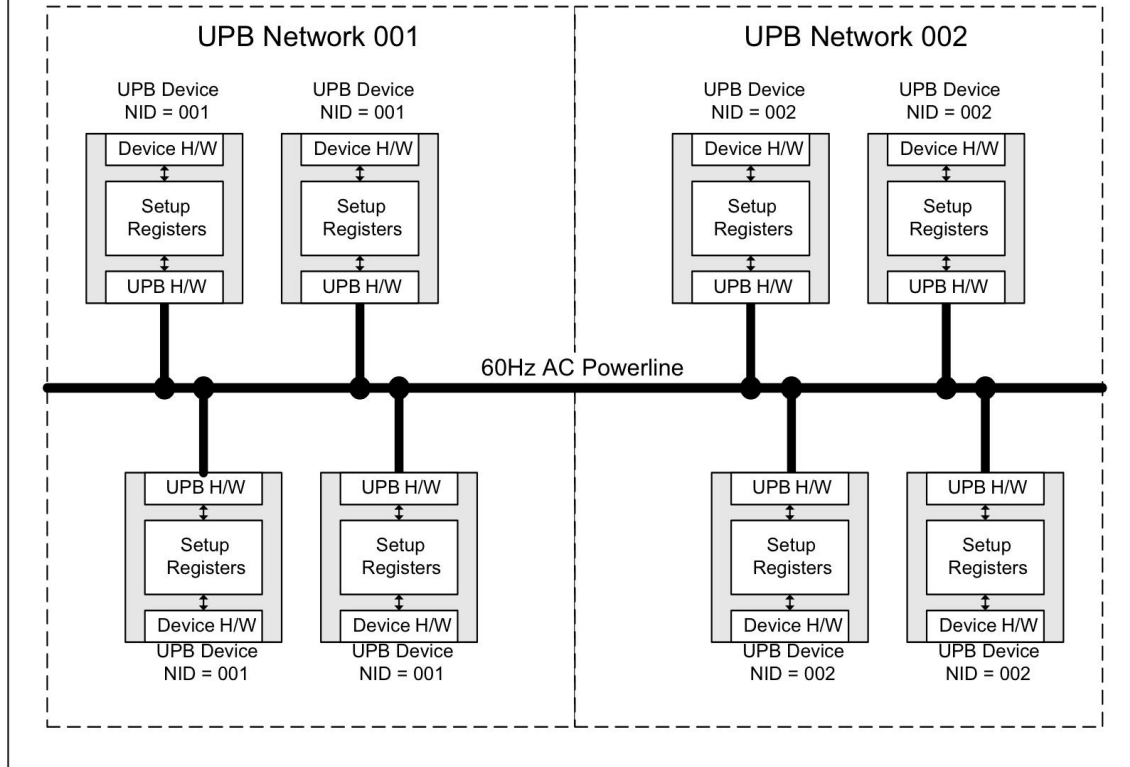
# The UPB Communication Packet



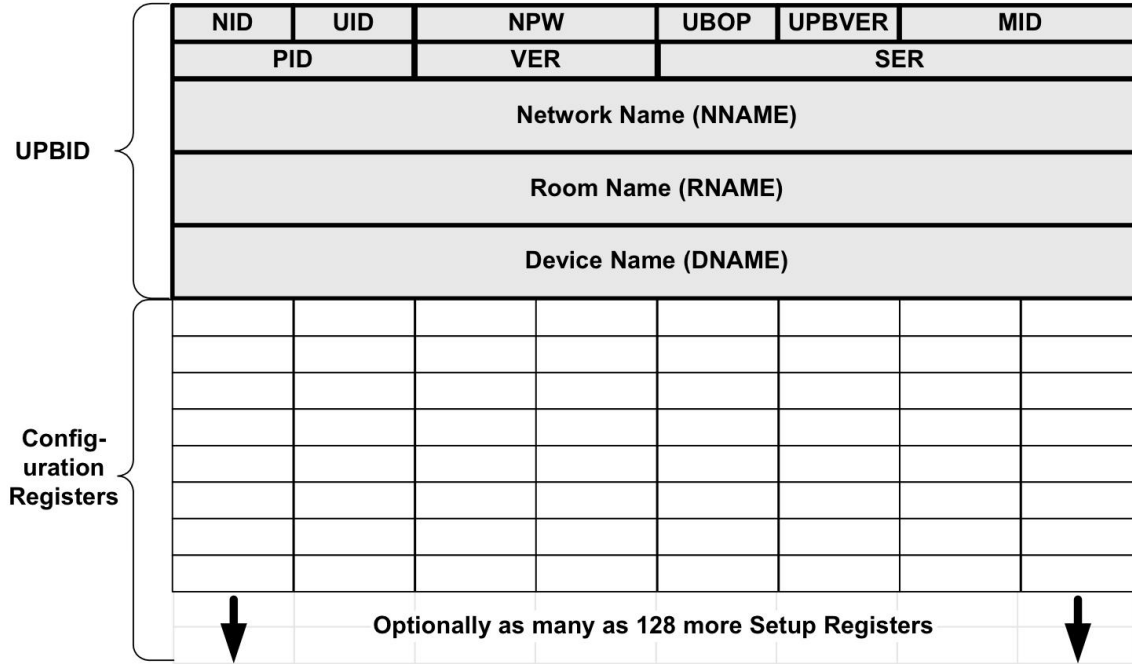
# The UPB Communication Packet



# The UPB System Model



## The UPB Setup Registers



# Controlling Linked Device Components

