Drivers spend too much time in parking lots trying to find an open space. We are aiming to design a smart parking lot to ease the process of finding a parking spot. Using small, low-cost sensors and long-range, low-power transmission, we have developed an affordable solution to this problem. With a cloud database and an easy-to-use mobile accompanying app, Parkingbase makes it easy for users to obtain realtime information on every spot in the parking lot.

Vehicle Detection Unit

- Ferric Detection on Car Engines
- Lidar Detection on Car Chassis
- Wireless Charging
- Engineering Plastic Cases
- LoRa long-range communication

Key Components

- MCU: STM32L053R8
  - Low-power consumption
  - SPI / I2C / USART interconnect
- Wireless Charging: BQ51013B
  - WPC v1.2 compliant communication control
  - Accurate voltage and current loops
  - High-efficiency and low-power dissipation
  - Small package size
- LoRa: SX1276
  - LoRa Modem
  - Programmable bitrate up to 300kbps
  - SPI interface
- Lidar (Time-of-Flight): VL53L0X
  - Time-of-Flight laser-ranging module
  - I2C interface for device control and data transfer
  - 940 nm Vertical Cavity Surface-Emitting Laser
  - Effective detection range up to 110 cm
- Magnetometer: RM3100
  - High-resolution magneto-inductive sensor with 3-axis sampling
  - SPI interface
- Gateway Unit
  - Adafruit LoRa Radio Bonnet with OLED • RFM95W @ 915MHz
  - SPI Interface for Lora and I2C used for LED display
  - RFM9x Adafruit Library used for packet processing
  - Connected to REST API server backend

Each parking spot will be installed with a sensor unit.

Scalability

The backend server pushes current parking availability to the user front end.
A local gateway arbitrates update requests and uplink status to the backend server.

User Interface

- View the status of all spots within a parking lot
- One click to find and reserve an open parking spot
- App will navigate you to your reserved spot
- Remembers where you parked - view parking history
- Supports Google and UCSB NetID login
- Editor tool for admins to easily view, add, and remove parking sensors

Software Frameworks and Technologies

- Progressive Web Application (PWA)
  - Works on all iOS and Android devices and looks like a native app
- Frontend built using and Chakra UI
- Backend built using Next JS and deployed on Vercel
- Application database built using MongoDB

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