S A B L E

Spec Sheet

The Secure Authentication Bluetooth Low Energy (SABLE) platform is a three piece system for collecting mobile tolls. The platform consists of a mobile application, a small sensor with antenna, and a backend authentication system.

Mobile Application The mobile application is a highly efficient and secure way for users to turn their phones into transponders.	♦ Cost: **FREE** to the user . ♦ The application transmits transitory, encrypted identifiers that change every second. ♦ The mobile device has a variable transmission rate of around seven to ten hertz or (7-10 advertisements per second). This enables our sensors to effectively collect transmitted advertisements while traveling at high speeds past our sensors. ♦ The identifiers are broadcasted using the Bluetooth low energy (BLE) 2.4GHz bandwidth. This is an advertising frequency that does not interfere with the operation of other Bluetooth or Wi-Fi devices. ♦ The application is currently supported on any android device with Bluetooth 4.0 or greater and has capabilities on iPhones as well.
Sensor The sensor is a single board computer that captures BLE packets and interfaces with the backend authentication system.	♦ Cost: $15-$40 per board ♦ The sensor is booted with a Debian-based Linux operating system. ♦ The sensor has an embedded Bluetooth 4.0 module that enables the system to capture BLE packets. ♦ The wireless module is connected to an on board U.FL connector that enables an external antenna attachment. ♦ With the integration of license plate billing systems, SABLE is able to function with 100% reliability. ♦ With an attached external antenna, the sensor has increased scanning range capabilities allowing BLE advertisements to be captured at virtually any speed. ♦ Sensor is internet connected to the backend system to send captured BLE advertisements to the Backend system. ♦ Capturing BLE advertisements from a mobile device anywhere inside a car traveling speeds of up to 80 Mph have been successfully tested.

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Antenna The antenna is connected to the sensor and detects BLE advertisements.	♦ Cost: $25 ♦ An external antenna is connected to the wireless module through a U.FL to SMA connector and a coaxial cable. ♦ The external antenna is an Altelix brand high gain wireless antenna capable of capturing signal in the 2400-2500 MHz bandwidth. ♦ The antenna has a gain of 20 dBi and a vertical and horizontal beam width of 18 degrees. ♦ The antenna has a maximum power of 50 Watts and Impedence of 50 Ohm. ♦ The external antenna allows the sensor to capture BLE advertisements with a more accurate radio signal strength and indication of distance. ♦ The antenna has the capability to capture BLE advertisements up to 300 meters away. ♦ The antenna allows for a more customizable scanning area for various toll collection requirements. ♦ The antenna is lightweight, easily installable, and has a low cost.
Backend Authentication System Computer resources and software that authenticates captured BLE packets and handles requests from mobile applications.	♦ Cost: scales with usage based on Google Cloud Platform (GCP) pricing. ♦ The backend is hosted on the GCP utilizing their pay-for-what-you-use App Engine feature. ♦ The backend consists of a secure database and necessary endpoints for application users and our sensors. ♦ The backend system is able to handle sensor requests to identify, authenticate, and authorize user payments and physical location access in real-time. ♦ The system is able to communicate and confirm with users about transactions and receipt information for a fully 100% reliable system. ♦ The backend is scripted in python using secure restful endpoints on the Flask framework. ♦ The system is self-scalable, requires little maintenance, and only utilizes resources that are needed by the system.