



Data Dictionary of Multi-functional Smart Lampposts for Positioning Devices

Version 1.04

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Version	Details of Change	Effective Date
1.0	Initial Release.	28 June, 2019
1.01	Minor update	23 July, 2019
1.02	Minor update	28 August, 2019
1.03	Minor update	29 April, 2022
1.04	Minor update and examples added	08 August, 2024

Introduction

The implementation of Multi-functional Smart Lampposts (Smart Lampposts) is to promote smart city development. The Lands Department (LandsD) is responsible for the provision of positioning services to public. The positioning devices of LandsD installed on Smart Lampposts include Bluetooth Beacons, RFID Tags, and Geo-QR Codes. Developers can make use of those positioning devices and the corresponding open data to develop positioning related applications.

1. Bluetooth Beacon

The Bluetooth Beacon transmits 2.4 GHz Bluetooth Low Energy (BLE) signals containing unique beacon identifier (ID) for real-time positioning applications with about 5m positioning accuracy for general smartphone (both iOS and Android) users. For each lamppost, 2 Bluetooth Beacons are installed at about 4-5m above ground and 2 others are installed at about 2-3m above ground.

2. RFID Tag

The RFID tag pack consists of 3 passive Ultra-High Frequency (UHF) RFID Tags. They are installed evenly along circumference of each lamppost base and at height of 0.1m above ground.

The passive RFID Tags store the corresponding lamppost number and relevant location information. The information can be retrieved by common commercial RFID readers remotely at range up to 10m for various location-based applications, such as navigation application for visually impaired persons.

3. Geo-QR Code

3.1 Geo-QR Code Tag

The Geo-QR Code Tag consists of a passive Near Field Communication (NFC) tag readable by smartphones (both iOS and Android) and one Quick Response Code (Geo-QR Code) printed on the cover panel of the tag (Image 1). It is installed at about 1.3m above ground, facing towards pedestrian walkway.

The Geo-QR Code provides accurate positioning information and a platform to access nearby geographical information. The passive NFC tag provides users with high security positioning data and lamppost information for various location-based applications, such as emergency reporting, check-ins, etc.



Image 1 - Geo-QR Code Tag
(Sample – not to scale)

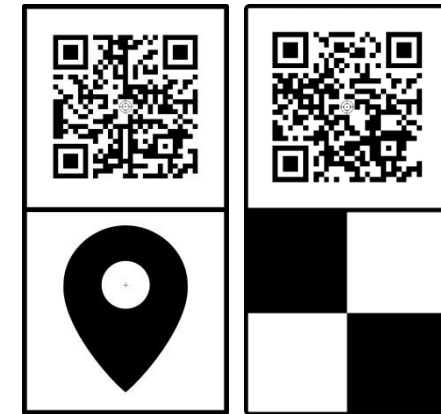


Image 2 - Geo-marker
(Sample – not to scale)

3.2 Geo-marker

The Geo-marker is a 150mm x 300mm aluminium plate consists of one Geo-QR Code and one Target Marker (Image 2) mounted at about 3m above ground facing carriageway. The Geo-marker provides accurate positioning information to support mapping and location-based applications.

The Geo-QR Code works as a unique visual identifier for the Target Marker annexed. The Target Marker can provide precise coordinates for supporting range of applications, such as creation and maintenance of high-quality 3D digital maps, production of geo-referenced street view videos, road inventory asset management, etc.

Datasets

Five datasets are provided for different positioning devices mounted on Multi-functional Smart Lampposts in JSON format.

Dataset	Information
Smart Lamppost (LP):	➤ Positioning information of the Smart Lamppost ➤ Unique ID: LP_NUM
Bluetooth Beacon (iBeacon) (IB):	➤ Broadcast information of the Bluetooth Beacon (iBeacon) ➤ Unique ID: “BLE_IB_MAJOR” + “BLE_IB_MINOR”
Geo-QR Code Tag (NFC):	➤ Positioning information of the Geo-QR Code Tag (NFC and Geo-QR Code) ➤ Unique ID: LP_NUM
RFID Tag (RFID):	➤ Positioning information of the RFID Tag ➤ Unique ID: RFID_TID
Geo-marker (GM):	➤ Positioning information of the Geo-marker ➤ Unique ID: GM_ID

● Datasets:

Dataset					Field	Data Type	Description	Allow Null	Remarks
LP	IB	GM	NFC	RFID					
✓	✓	✓	✓	✓	LP_NUM	String	Lamppost number	NO	● Example: 42373
✓	✓	✓	✓	✓	LP_NORTH	Numeric	Northing coordinates (HK1980 Grid) of lamppost	NO	● Round to the nearest 0.1 m ● Example: 815760
✓	✓	✓	✓	✓	LP_EAST	Numeric	Easting coordinates (HK1980 Grid) of lamppost	NO	● Round to the nearest 0.1 m ● Example: 835961.6
✓	✓	✓	✓	✓	LP_GL	Numeric	Ground level of lamppost above Hong Kong Principal Datum (HKPD)	NO	● Round to the nearest 0.1 m ● Example: 3.9
✓	✓	✓	✓	✓	LP_LAT	Numeric	Latitude (Decimal Degree) of lamppost in WGS84 (Reference Frame: ITRF96 (1998:121))	NO	● Round to the nearest 0.000001 degree ● Example: 22.280713
✓	✓	✓	✓	✓	LP_LONG	Numeric	Longitude (Decimal Degree) of lamppost in WGS84 (Reference Frame: ITRF96 (1998:121))	NO	● Round to the nearest 0.000001 degree ● Example: 114.173901
	✓				BLE_IB_UUID	String	UUID of Bluetooth beacon (iBeacon)	NO	● 32 hexadecimal digits split into 5 groups ● Example: B19AF0047F2A49728F3937D26C29CB9E
	✓				BLE_IB_MAJOR	Numeric	Major value of Bluetooth beacon (iBeacon)	YES	● 5 unsigned integer values (0-65535) ● Example: 14336
	✓				BLE_IB_MINOR	Numeric	Minor value of Bluetooth beacon	YES	● 5 unsigned integer values

Dataset					Field	Data Type	Description	Allow Null	Remarks
LP	IB	GM	NFC	RFID					
							(iBeacon)		(0-65535) ● Example: 10004
	✓				BLE_IB_TX	Signed integer	Transmission power (Tx power) in dBm unit of Bluetooth beacon (iBeacon)	YES	● Example: -20
	✓				BLE_IB_HGT	String	Location of Bluetooth beacon above ground U = Upper, L = Lower	YES	● Example: L
				✓	RFID_TID	String	Transponder ID of RFID Tag	YES	● Example: E280110C20008AD4A13C0AFF
				✓	RFID_EPC	String	Electronic Product Code of RFID Tag	YES	● Example: 4C237F445649F50105272640000000082A7F5383670A1A000401000000000000
			✓		NFC_URL	URL	URL of Geo-QR Code Tag	NO	● Example 1: https://www.geodetic.gov.hk/LP/?LP=42373&geo=22.280713,114.173901,2.1 ● Example 2: https://www.geodetic.gov.hk/LP/?LP=42373
			✓		NFC_GEOURI	String	Uniform Resource Identifier for Geographic Locations of lamppost (IETF RFC 5870)	NO	● Example 1: geo:22.280713,114.173901 ● Example 2:

Dataset					Field	Data Type	Description	Allow Null	Remarks
LP	IB	GM	NFC	RFID					
									geo:
			✓		NFC_LP	String	Lamppost number (for Geo-QR Code Tag)	NO	Example: LP:42373
			✓		NFC_HK80	String	HK1980 grid coordinates of lamppost (for Geo-QR Code Tag)	NO	- Example 1: HK80:824584.0N,829798.0E,2.1H - Example 2: HK80:
			✓		NFC_UID	String	NFC UID	NO	Example: UID:04F94A0AAA5280
			✓		NFC_LOC	String	Location code (Reserved)	NO	Example: LOC:
			✓		NFC_TIME	String	Last modified time of Geo-QR Code Tag content	NO	Example: TIME:2019-05-22
			✓		NFC_VER	String	Version of Geo-QR Code Tag content format	NO	Example: VER:1.0
			✓		NFC_SHA256	String	SHA256 hash of the Geo-QR Code Tag content	NO	Example: SHA256:7BB3941803DD68F60DB0EA51A45A39959489DBA0984BD787E38988514062B83B
		✓			GM_NORTH	Numeric	Northing coordinates (HK1980 Grid) of surveyed mark on Geo-marker	YES	- Round to the nearest 0.01 m - Example: 817609.34
		✓			GM_EAST	Numeric	Easting coordinates (HK1980 Grid) of surveyed mark on Geo-marker	YES	- Round to the nearest 0.01 m - Example: 836396.21

Dataset					Field	Data Type	Description	Allow Null	Remarks
LP	IB	GM	NFC	RFID					
		✓			GM_ID	String	Unique ID for Geo-marker: LP no. + GM1A/B	YES	Example: AB1234GM1A
		✓			GM_HGT	Numeric	Height above Hong Kong Principal Datum (HKPD) of surveyed mark on Geo-marker	YES	- Round to the nearest 0.01 m - Example: 7.17
		✓			GM_URL	URL	URL of Geo-marker	YES	Example: https://www.geodetic.gov.hk/LP/?LP=42373#GM1A
✓					GM2_HGT	Numeric	Height above Hong Kong Principal Datum (HKPD) of marker plate attached on lamppost top	YES	- Round to the nearest 0.01 m - Example: 20.24

Application Programming Interface (API) service

The API provides the datasets for different positioning devices mounted on Multi-functional Smart Lampposts.

- Using GET request:

<https://www.geodetic.gov.hk/lpapi/?<variables>=<values>>

- Example Requests:

Get information of specific type of positioning device

- Example 1: Get Smart Lamppost information

<https://www.geodetic.gov.hk/lpapi/?db=lp>

- Example 2: Get information of all positioning devices

<https://www.geodetic.gov.hk/lpapi/?db=all>

Get information according to specific conditions (e.g. Lamppost Number or Search Area)

- Example 3: Select by Lamppost Number

<https://www.geodetic.gov.hk/lpapi/?db=all&lp=DF3633> or

<https://www.geodetic.gov.hk/lpapi/?db=nfc&lp=DF3633>

- Example 4: Select by defined search area (HK1980 Grid coordinates)

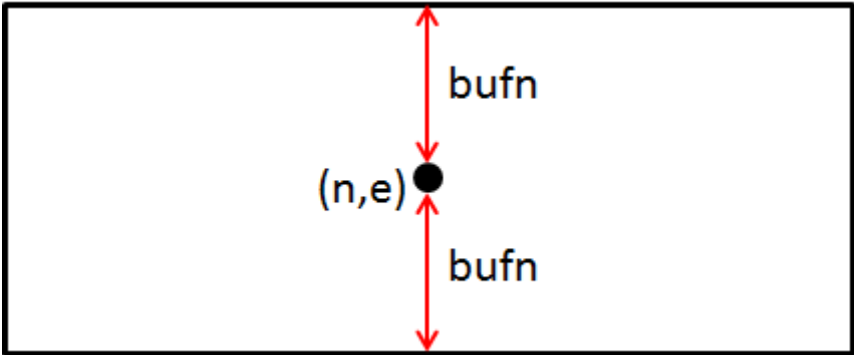
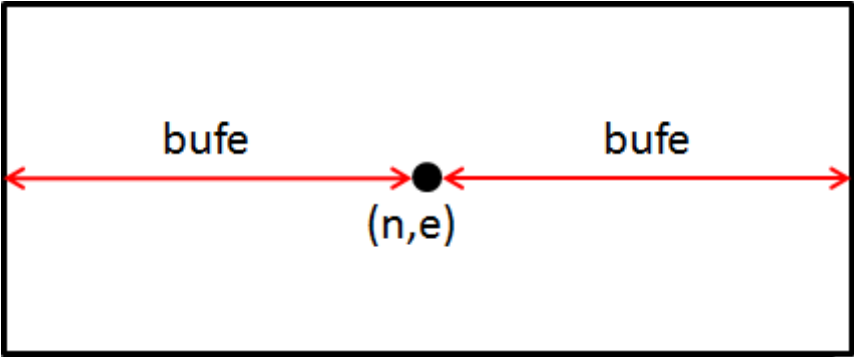
<https://www.geodetic.gov.hk/lpapi/?db=all&n=820333.9&e=839798.4&bufn=20&bufe=20>

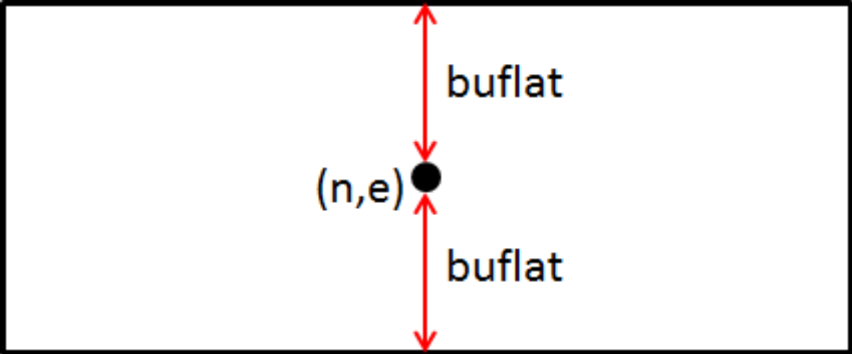
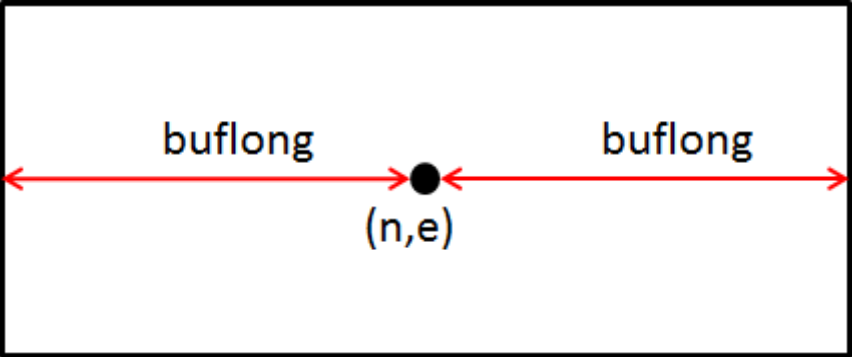
- Example 5: Select by defined search area (WGS84 Geographical coordinates)

<https://www.geodetic.gov.hk/lpapi/?db=all&lat=22.2&long=114.12&buflat=100&buflong=100>

- Variables:

Variables (Case insensitive)	Description	Remarks
db	Database	● <u>Mandatory</u> variable ● Valid values (case insensitive): LP (Smart Lamppost) IB (Bluetooth Beacon - iBeacon) NFC (Geo-QR Code Tag) RFID (RFID Tag) GM (Geo-marker) ALL (All positioning devices)
lp	Lamppost number	● Lamppost number assigned by Highways Department ● Example: DF3633
n	Northing (HK1980 Grid coordinates)	● Northing coordinate of the centre point of the search area ● Unit: metre
e	Easting (HK1980 Grid coordinates)	● Easting coordinate of the centre point of the search area ● Unit: metre
bufn	Buffer in north-south direction	● Buffer from the centre point in north-south direction ● Unit: metre

Variables (Case insensitive)	Description	Remarks
		
bufe	Buffer in east-west direction	● Buffer from the centre point in east-west direction ● Unit: metre 
lat	Latitude	● Latitude of the centre point of the search area
long	Longitude	● Longitude of the centre point of the search area

Variables (Case insensitive)	Description	Remarks
buflat	Buffer in north-south direction	● Buffer from the centre point in north-south direction ● Unit: metre 
buflong	Buffer in east-west direction	● Buffer from the centre point in east-west direction ● Unit: metre 

- End -