

# A Multi-lingual pedestrian navigation and campus guidance system using CloudMade API

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## 1. Introduction

The importance of a good campus navigation system cannot be ignored as the users will vary from students, special guests, visitors and multi-lingual attendees. Providing a navigation and guidance system with a multi-lingual interface helps in personalizing the system according to the user's preference for the language of interaction. [Pascal Neis, 2009] is an example of a multi-lingual routing application for navigation developed at the University of Bonn where optimal paths are generated with textual description in the user's preferred language. Natural language generation (NLG) is the subfield of artificial intelligence and computational linguistics. It is concerned with the construction of computer systems that can produce understandable texts in human languages and form some underlying non-linguistic representation of information in order to meet specified communicative goals [McDonald D.D., 1987].

### 1.1 Why CloudMade API?

Route description can be easily generated based on result of path planning. It is usually made up of road/street names, distance, directions and location information. CloudMade utilizes the open source geo-wiki, OpenStreetMap (OSM) data and provides routing API which includes route description in English. CloudMade Web Map Lite API [CloudMade Routing, 2009] makes it very easy to develop and generate turn-by-turn direction steps for navigation. The template used to generate driving direction gpx file in a particular language, has to be written in the language of one's choice as described in Table 1. CloudMade then updates the language template in their server and then by replacing the lang option with 'de', 'en', 'zh' or with 2 letter code for other languages, it is possible to get directions in the preferred language. But for data like building, street names, the translation has to be made individually for each of the options and isn't generic. So for this there is a need to have a database with the names of buildings, streets and points of interest in the preferred language

## 2. System Description

We present a multi-lingual, pedestrian navigation and campus guidance system which has interfaces in English and Chinese. Personalization begins with providing information to the user in the language he/she understands best and is used to. In this prototype the CloudMade Web Map Lite API which uses OpenStreetMap (OSM) has been used for creating the web interface. The system generates shortest pedestrian paths using both outdoor pavements and indoor corridors between various buildings and points of interests (POI) with route description both in English and Chinese.

### 2.1 Multi-lingual Web Interface

The system was designed initially for use during the China-Ireland ICT Conference [CIICT, 2009], in which we have delegates mostly come from universities in China and Ireland. The interface is available both in English and in Chinese and we are also working on creating an Irish version. Fig.1 shows the campus navigation system web interface provided in the Chinese language. It is intended to create a more general campus guidance system which will suit any kind of user.



Fig.1 Chinese web interface for Campus Guidance and Pedestrian Navigation

The routing description template as shown in Table.1 is used to incorporate the Chinese language into the CloudMade Web Map Lite API in which there is a turn-by-turn description for routing and points of interest. The Chinese version of the navigation and guidance system is available on the conference page [CIICT Chinese, 2009]. In the future it is planned to include French, German, and Polish languages as the other language options. Fig.2 shows an area of the campus with the names of buildings displayed in Irish. The map tiles for the Irish map have been generated by the OSM data that was downloaded and stored in the University server in a PostgreSQL database. The tiles with the Irish names were then created by extending the rendering engine from Mapnik. Irish place names were assigned to streets, roads, lanes, and paths by changing how the map rendering software labeled the OpenStreetMap features in the database. The style file for the map rendering software (Mapnik) was configured to give precedence to Gaelic names for features.



Fig.2 Names of building in campus in Irish

## 2.2 Travel and transport for the conference

Understanding the local public transportation system by people visiting a new country for the first time can be very difficult. Fig.3 shows how the use of markers at important transit and travel related points can be used to give useful information to the user in their local language.



Fig.3 Airport marker with links to various information useful to the user

## 2.3 Pedestrian Navigation

Pedestrian navigation is an important feature of the system. It includes both indoor corridors and outdoor pavements to generate the most optimal route. The following line of code is used for generating the optimal path between two or more points within the area of interest.

```

waypoints = [A, B];
routetype = {travelMode: 'foot', draggableWaypoints: (1), lang:
'en' };
directions.loadFromWaypoints(waypoints,routetype);

```

The variable 'waypoint' stores the lat/long values of the start (A) and end (B) points.

'travelMode' can be set 'car', 'foot', or 'bicycle' based on the kind of route that needs to be generated by the user. In the campus navigation system, the assumption is it is going to be used by pedestrians. Thus 'travelMode' is set to 'foot'.

'draggableWaypoints' is set to '1'. This will enable the user to manually place the start and end point based on exact location by dragging it to the appropriate point.

'lang' option can be set to 'de', 'en', 'zh' or with 2 letter code for other languages in which the user prefers the output textual description of the generated path to be.

'directions.loadFromWaypoints' is the function that generates the path.

The elements of the description rules are as follows [Routing Properties, 2009]:

Element	English	Chinese
m	m	米
km	km	千米
ft	ft	英尺
miles	miles	英里
head_on_pattern	Head %s1 on %	沿 %s2 向前 %s1
head_on_pattern_unnamed	Head %s	向前 %s
earth_direction_N	north	北
earth_direction_NE	northeast	东北
earth_direction_E	east	东
earth_direction_SE	southeast	东南
earth_direction_S	south	南
earth_direction_SW	southwest	西南
earth_direction_W	west	西
earth_direction_NW	northwest	西北
turn_C	Continue on %s	沿 %s 继续走
turn_TSLR	Slight right at %s	在 %s 偏右转
turn_TSHR	Sharp right at %s	在 %s 正右转
turn_TR	Turn right at %s	在 %s 右转
turn_TL	Turn left at %s	在 %s 左转
turn_TSLL	Slight left at %s	在 %s 偏左转
turn_TSHL	Sharp left at %s	在 %s 正左转
turn_TU	Make a U-turn	反向转
turn_C_unnamed	Continue	继续走
turn_TSLR_unnamed	Slight right	偏右方
turn_TSHR_unnamed	Sharp right	正右方
turn_TR_unnamed	Turn right	右转
turn_TL_unnamed	Turn left	左转
turn_TSLL_unnamed	Slight left	偏左方
turn_TSHL_unnamed	Sharp left	正左方
turn_TU_unnamed	Make a U-turn	反向走
unknown_road	Unknown road	无名路
unknown_road_near	Unknown road near %s	%s 附近无名路

roundabout_take_the_exit	At the roundabout, take the %s1 exit onto %s2	在环岛处, 沿%s2 走%s1出口
roundabout_take_the_exit_unnamed	At the roundabout, take the %s exit	在环岛处, 走 %s 出口
exit_1	1 <sup>st</sup>	第一
exit_2	2 <sup>nd</sup>	第二
exit_3	3 <sup>rd</sup>	第三
exit_4	4 <sup>th</sup>	第四
exit_5	5 <sup>th</sup>	第五
exit_6	6 <sup>th</sup>	第六
exit_7	7 <sup>th</sup>	第七
exit_8	8 <sup>th</sup>	第八
exit_9	9 <sup>th</sup>	第九

Table 1. Template for generation of route description

An example of route description using the above rules is shown in Fig.4.

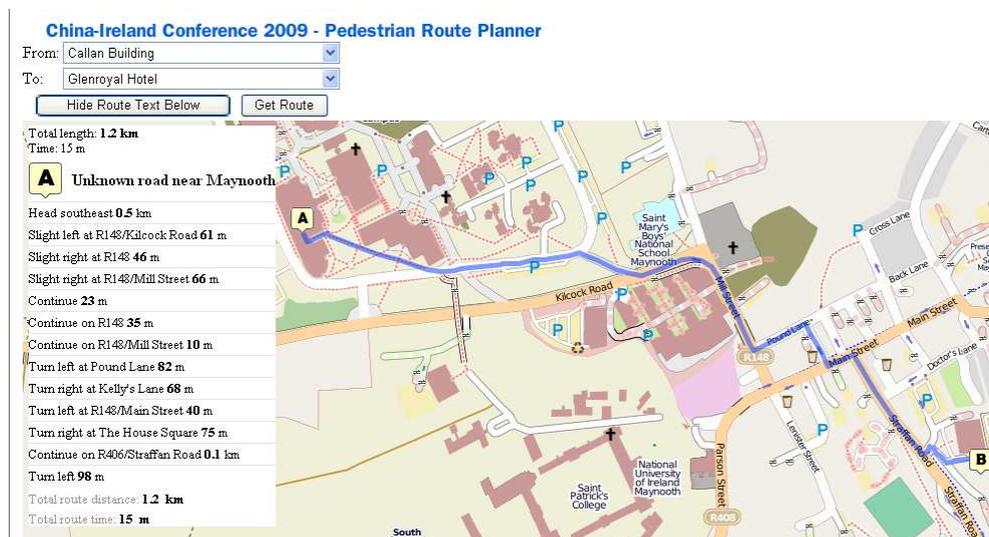


Fig.4 Optimal path with route description in CICT2009 conference website

As seen in Fig.4, the user is able to reach the destination following the route description which is usually made up of road/street names, the distance, the direction, time taken for the path. Apart from this, supplementary location information could also be included by accessing the geographical information in the OpenStreetMap database. We intend to add value to the directions given by CloudMade API by including more descriptive, landmark based navigation. In the above example, CloudMade API gives a result in which in Step 10 it says: "Turn left at R148/Main Street". Instead by extracting some information about the point of interest in that area we can replace that by "Turn Left when you see O'Neills Pub on you right and Bank of Ireland across the road" as it will be easier for the user especially if he/she is new to the place.

Also instead of "Continue 23m" we could say "You will pass Dunnes Stores and Coffee Mill on your right".

But when translating such information, various rules and syntaxes of that language must be followed. Route description in Chinese can basically follow the same rules. However,

there still needs to be different rules for route description in Chinese to meet the habits of Chinese users. The following are some such examples.

- head\_on\_pattern = Head %s1 on %s2

The structure in English is:  $\frac{Direction + Distance}{part1} + \frac{Preposition + Streetname}{part2}$

That in Chinese should be:  $\frac{Preposition + Streetname}{part1} + \frac{Direction + Distance}{part2}$

The element in Chinese should be as follows:

head\_on\_pattern = 沿 %s2 向前 %s1

- roundabout\_take\_the\_exit = At the roundabout, take the %s1 exit onto %s2

In this case, it is the same rule. The element in Chinese is as follows:

roundabout\_take\_the\_exit = 在环岛处, 沿%s2 走%s1出口

- turn\_TSLR = Slight right at %s
- turn\_TSHR = Sharp right at %s
- turn\_TSLL = Slight left at %s
- turn\_TSHL = Sharp left at %s

These four are following the same rule.

The structure in English is:  $\frac{Direction + Distance}{part1} + \frac{Preposition + Location}{part2}$

That in Chinese should be:  $\frac{Preposition + Location}{part1} + \frac{Direction + Distance}{part2}$

The element should be as follows in Chinese:

- turn\_TSLR = 在 %s 偏右转
- turn\_TSHR = 在 %s 正右转
- turn\_TSLL = 在 at %s 偏左转
- turn\_TSHL = 在 %s 正左转

Other elements can be translated directly into Chinese [English-Chinese GIS Dictionary, 2001]. In the solution, UTF-8 character set is used to realize the presentation of Chinese characters on website. Another rule for Chinese translation is to keep the location, building or street name in English. As to these specific terms, they are usually translated into Chinese by their pronunciation. However, each syllable might have many corresponding Chinese characters so it is appropriate to keep some of the lesser heard place names in English.

### 3. Conclusion and future work

In this paper we demonstrated a multi-lingual navigation and campus guidance system based on open source OpenStreetMap data using a simple easy to program and use CloudMade Web Map Lite API. We are currently using the English and Chinese versions for CIICT 2009 conference as examples. The Irish version is being worked upon. After summarizing the differences in descriptions of POI (Point of Interests) and Routing, we made reasonable modifications based on descriptions rules for Chinese and Irish version. As CloudMade provides simple routing description rules in English version, we plan to extend the description rules for more complicated cases both in English version or other language ones. The route description in CloudMade is generated using a gpx file which is created when the routing algorithm of CloudMade is called within our program. We intend to access and alter this file using PHP in order to include Building names as part of the pedestrian navigation route description. Understanding on how to describe routing and POIs in 3D environment is also a useful future research topic. We plan to contribute to the future development of the Cloudmade Web Lite API in the area of multi-lingual functionality for routing and navigation. The use of special tags for wheel chair users within the OpenStreetMap database can help us identify ideal routes for the user by being able to include only the wheel chair access points and paths within the area when the shortest path is generated.

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