

PHYSICAL AND DIGITAL INFORMATION SYSTEMS FOR HIKING TRAILS: TOWARDS A SYSTEMATIC CONCEPTUALIZATION AND SURVEY

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Abstract. Recreational and touristic trails form an important infrastructure for outdoor activities, and therefore, their study is highly relevant for recreational geography. Despite the prestigious culture of trails and the recent achievements in their digitalization, we do not know about a systematic survey regarding the features of different tools and assets. Mutual understanding on a global level is hampered by a lack of conceptual and terminological clarification of the complex phenomena of trails and their networks, signage and marking systems in different parts of the world. By observing and analysing trail networks and their signage systems of various regions, as well as current typical digital platforms available for trails, we may identify universal key concepts and aspects of both the physical and digital information systems of trails. This study identifies key notions and aspects based on some typical examples and can be a starting point or initiate discussion towards a unified conceptualization of trail systems in the field of recreational geography worldwide, and utilize that framework in the future for studying and developing trail systems and their digital tools and platforms in a more coherent and integrated way.

Different regions and countries have developed a variety of trail layouts, signage systems, development and management patterns [21]. Trail systems usually involve multiple stakeholders and contributors, and function organically with the linked tourist attractions, natural or cultural heritage sites, populated places, services and facilities. Trail marking and signage systems have formed traditionally the “physical information system” for both local and foreign visitors, while digital platforms have been developed and become popular in the last decades, thanks to the availability of the satellite-based positioning systems. Digitalization – if done properly – not only helps visitors to find suitable tours and navigate along the trails, but eases the work of trail communities, developers, managers, and maintenance personnel as well. Related studies and scientific work has been growing in different areas related to various fields ([2,5,9,18,24] as a couple of examples), each having their own approaches. However, we do not even know about a systematic survey regarding the features of different tools and assets, nor a conceptual and terminological clarification regarding trails and their signage or marking systems applicable to different parts of the world. Languages tend to have different concepts for the same reality, and even the concept of *trail* or the usage of words like *route*, *tour*, *itinerary*, *trip* are not the same for everyone. Although terminology may remain different in various areas and professional fields, the following variant is now proposed, based on [11], as a reference model for evaluation and comparison of different systems and approaches. This can also be envisioned in an integrated digital information system (Fig. 1) [12].

Taking the observations and conceptualization introduced in [11], we may use *trail* as a general term for the path/road infrastructure designated for the outdoor activity in question (here: walking, hiking), and define a *trail network* (*GeoTrNet*), mathematically as a graph, consisting of *trail sections* and *trail nodes* (junctions and other important points along the trails). On top of this graph, named *locations* and *points of interest (POIs)* may be assigned to a trail node, while a *route* is a continuous (may be complex), uniquely designated and identifiable path in this graph in one direction (with explicit reversal for bidirectional routes), which can be split into arbitrary *stages* between nodes, and may have variants, side-trails, defined as separate routes but explicitly linked to the main route. The visitor may walk along *trips* (a.k.a. *tours*), which are prepared recommended or freely composed paths consisting of subsequent route stages (or whole routes).

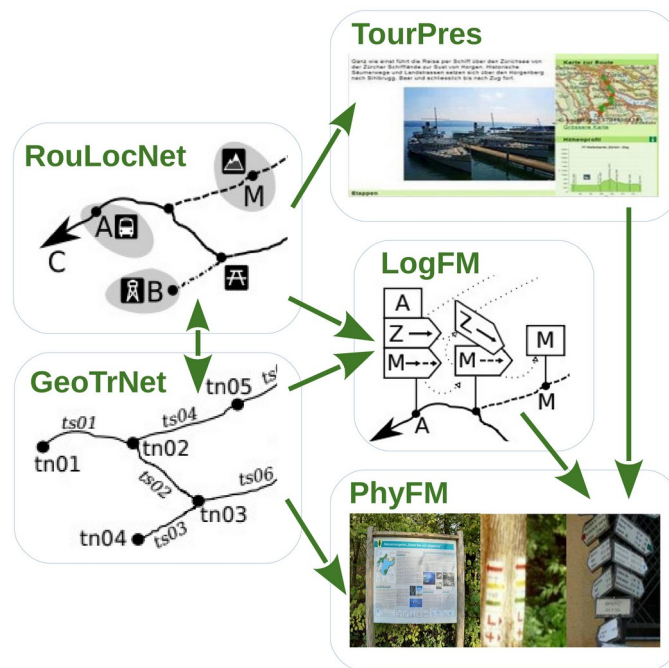


Fig. 1. Model suite of the envisioned TrailSigner information system

Touristic presentation assets (TourPres), such as guide texts, photos or other media content, precompiled maps, etc. may be added to routes, route stages, trail nodes, locations, or to precompiled trips themselves. *Logical facility management (LogFM)* is the planning and managing signpost contents to make and keep a coherent and consistent system of them and is about what to write at which point (locations, destinations along trails and additional data such as difficulty, distance, walking time, trail mark symbol). Production, installation, maintenance of signs and waymarks are tasks of *Physical facility management (PhyFM)* processes.

Properties of digital trail platforms can be characterized based on their features and capabilities as listed above (s. Table 1). Some of them focus on the map and trail graph for free trip planning (mostly based on the popular and sophisticated OpenStreetMap public and volunteer-based map database), some contain more precompiled trips, and may have different levels of facility management support [6]. We may observe the limited support of systematic signpost planning and management in all listed systems [11].

Table 1. Examples of digital platforms for trails with their features

Digital Information System	Ownership	Trail network	Trail routes	Tour presentation	Logical signage management	Facility Management
OpenStreetMap w/ its services [14]	community	routes based on network	structured		partial	indirectly
WikiLoc [22]	community		trails/tours	trail-based (edited/user)		
OutdoorActive [15,23]	proprietary, w/ user trips	tours and network	as tours	edited tours, user share	partial	directly (by module) [8]
NatursportPlaner [13,23]	proprietary	network of trails	trails		partial	directly
OuterSpatial [2,16]	proprietary		trails/tours	edited tours		directly
GuideAtHand [10]	proprietary w/user reports		tours	edited tours (audio guide)		
Relive [17]	proprietary, user trips		tours	user share		

Elements of physical (on-site) trail marking and signage system can be defined as the *signage stack*, where elements build on each other and – ideally – form a coherent system: simple *trail marks* or *blazes* [7] show the way step-by-step (either by a route-based or a junction-based marking system approach [1], using simple markers denoting usage mode, trail type or role in the network, difficulty and/or route reference); *route identifiers* contain a route logo, number and/or name; *signposts* show locations, directions towards destinations and their distances along the trails; and *info boards* (including *trailhead signs*) enhance the signage with overview maps, regional or local information. These items can be directly based on the digital touristic presentation assets. All this can be extended with *warning* and *regulatory signs*. Properties of trail marking and signage systems can be evaluated according to their marking approach and signage stack properties (Table 2), taking into account the organizational background. We may observe strengths and weaknesses of these systems.

Table 2. Examples of physical trail signage systems with their properties

Physical Signage System	Management organization	Trail marking system approach	Trail blaze symbol expression	Trail route identification	Signposting	Information Boards / Trailhead Signs
Swiss [4]	transport authority & hiking orgs.	junction-based	difficulty	logos of highlight routes	full, unified (time-based)	standard format
Slovenian [21]	mountaineering federation	junction-based with some routes	route / section type	some named routes	full, unified (time-based)	not standardized or systematic
Slovak [21]	tourist club (hiking federation)	locally route-based	route distinction, network role	some named routes	full, unified (time-based)	not standardized or systematic
Hungarian [21]	hiking federation & diverse (local actors & some forestries, orgs.of thematic routes)	locally route-based	route distinction, network role	some named routes, thematic route logos	partial (regional & ad-hoc) (time/km-based)	not standardized or systematic
Camino de Santiago (Spain)	regional bodies, local actors	destination-oriented, junction-based	thematic network symbol	unified logo, main routes named	full, regional var. (milestones, km-based)	not standardized or systematic

We have identified key notions and aspects based on some typical examples of physical and digital information systems for designated hiking trails. This is based on a more detailed study with the aim of elaborating a conceptual model that can be used as a basis for designing an integrated information system for the management and presentation of trail networks [11, 20]. This brief analysis can be a starting point towards elaborating a unified conceptualization of trail systems in the field of recreational geography worldwide, and utilize that framework in the future for studying and developing trail systems and their digital tools and platforms in a more coherent and integrated way. Digitalization is taking place all over the world, and towards higher and higher levels, while on-site information still must be given for various reasons (safety, legislation, enabling the visitor to “switch off”, etc.). We can not predict how the role of physical trail information assets will evolve in a digital world, but changes are evident, and the proper understanding of the field requires a clear and systematic approach, which might become an important contribution and field of recreational geography. It also helps to reveal gaps, weaknesses and ambiguities, but also opportunities for improving the utilization of existing tools and resources, and their further development for the benefit of all trail users and stakeholders.

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