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Non-indigenous and Endangered Animal Record Keeping in the Czech Republic

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Anotace

V příspěvku je popsán způsob sběru, zpracování a vizualizace dat o výskytu některých nepůvodních a ohrožených druhů živočichů v České republice. Vytvořený software umožňuje široké odborné veřejnosti snadné vložení informací o pozorování sledovaných druhů. Získaná data jsou následně využívána odbornými a vědeckými pracovišti pro hledání optimálních řešení ochrany přírody a managementu populací a jsou přístupná veřejnosti.

Analytické a softwarové řešení bylo vyvinuto Katedrou informačních technologií České zemědělské univerzity v Praze, data jsou následně využívána Fakultou lesnickou a dřevařskou a Fakultou životního prostředí.

Klíčová slova

Zvířata, monitoring, životní prostředí, mapy, GPS, vizualizace, nepůvodní druhy, Česká republika.

Abstract

In the paper, the method of data collection, processing and visualization of the occurrence of non-indigenous and endangered animal species in the Czech Republic is described. Our new software enables easy data entry about the observation of monitored species to the expert public. The data obtained is then used by expert and scientific institutions in order to search for optimal solutions of nature protection and population management and results are open to the public.

This analytic and software solution was developed by the Department of Information Technologies, Czech University of Life Sciences; the data has been also used by the Forestry and Wood Faculty and the Faculty of Life Sciences.

Key words

Animals, monitoring, environment, maps, GPS, visualization, non-indigenous species, Czech Republic.

Introduction

Human activities in nature can result in many different effects of the workings of ecosystems and population. The composition of species of animals in the wild has been changing; original species have been disappearing and other non-indigenous species have been migrating, and this generates further disruption of the natural balance and has also impact on human activities (agriculture, fishery, forestry, etc.). The starting point of searching for solutions is the existence of data of occurrence of individual, endangered and migrated non-indigenous species (Vaněk, 2011).

Significant invasive species in the Czech Republic are primarily Raccoon dog (Nyctereutes procyonoides), Raccoon (Procyon lotor), American mink (Neovison vison) a Golden jackal (Canis aureus). On the contrary, the endangered species are e.g. Eurasian lynx (Lynx lynx), Brown bear (Ursus arctos), Gray wolf (Canis lupus), Western Capercaillie (Tetrao urogallus), Black Grouse (Tetrao tetrix) and Hazel Grouse (Bonasa bonasia) (Law 114/1992).

Observation of occurrence is relatively demanding: most information is gained from people who are regularly present in nature – foresters,

farmers, gamekeepers, nature fun etc. Collection of structured information from such a wide range of people who are not organized in a unified way is a relatively big problem (Svobodová, 2011). For this reason, there was a need to find a solution which collects as much data as easy as possible, so that this data could then be used by expert and scientific institutions in order to search for optimal solutions of nature protection and population management (Aarts, 2008).

Materials and methods

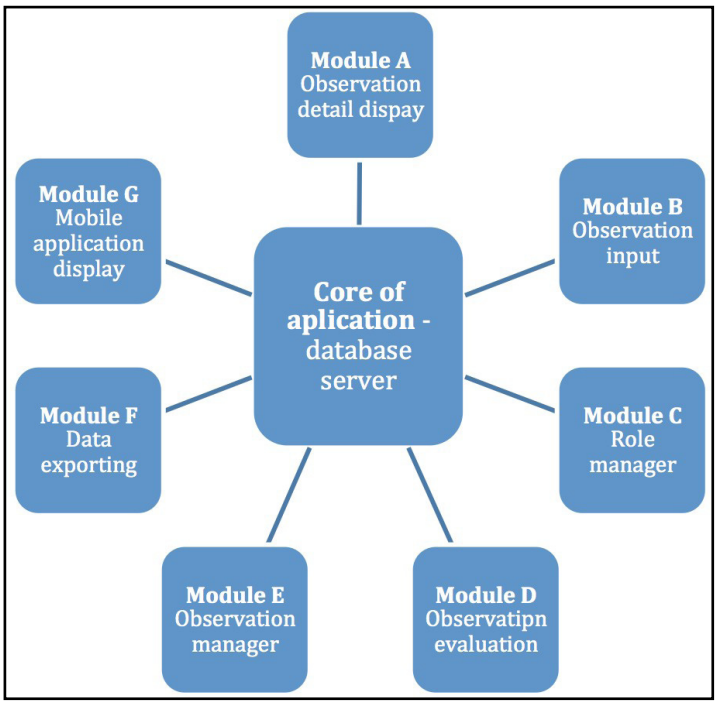
Based on the analysis, a prototype for verification of system functionality was created. Open source technologies were used for this development. All data obtained is saved on MySQL (My Structured Query Language) database server, version 5.6.10. The software solution of the web application was released in the standard environment PHP 5 (Hypertext preprocessor) programming language with use of Nette framework version 2 libraries (nette, 2013). The application architecture was modularly designed (Cui, 2009). This design enables easy and rapid development of other application functionalities as well as effective modification of current functions and current needs. The utilization of the Nette framework enables the creation of safe and effective modular applications (Figure 1). Dibi database layer is used for communication with the database server (dibi, 2013). The application supports mainly work within the MS SQL (Microsoft Structured Query Language) database server environment, but owing to Dibi database layer utilization, the application enables utilization in other commonly open database systems. Web server Apache version 2 guarantees running of the application.

Google Maps developed by Google Inc is used to view the animals monitored. Communication with Google Maps is realised via Google Maps JavaScript API V3 (Application Programming Interface). (Jarolímek, 2012) (Bearman, 2012) Display of information about detected animals is created by the client-side of JavaScript with use of jQuery framework (Thanopoulos, 2012)(Liao, 2012) (McCormick, 2004). The application is optimized for the most widely used web viewers, i.e. viewers running on different operating desktops, notebooks as well as mobile devices like tablets or smart phones (Leyshon, 2013).

Results and discussion

Requirements for the system

- The basic requirements are simplicity of operation; open to the general public and



Source: own processing

Figure 1: Single application modules.

the possibility of collecting and browsing of data saved (Vaněk, 2011).

- System function requirements:
- A public part for the data entering and browsing; and an internal (administrative) part for data validation, index adjustment and utilization of advanced functions of data analysis
- Friendly data entry for users
- Process of approval, validation and administration of entered data(observation)
- Possibility to use historical data (some species data has been accessible since 1960)
- Data selection and filtering
- Visualization of data – display on a map
- Possibility to use application on different types of devices (PCs, notebooks, smart phones, tablets) and operating systems
- Possibility to create new language versions of application
- Online availability of application

Web interface is composed of three basic sections (Figure 2).

- Heading – placement of control menu and switch between „Show“ mode for data display and „Add“ mode for data entry
- Map – display and data entry
- Menu in right column – form for selecting and filtering / obtaining data

Source: own processing

Figure 2: Web interface for monitoring of game, in this example, the occurrence of Raccoon dog.

Data entry

- Every visitor of web pages is enabled to contribute with the data in "Add" mode. Entered data of the observation:
- Species selection (Raccoon dog Raccoon, American mink, European otter, jackal, lynx, bear, wolf, Black Grouse , grouse, Hazel Grouse) and possibility to enter other species)
- Author´s e-mail – validation of identity*
- Date and time of the observation
- GPS (Global Positioning System) coordinates – by clicking on the map or directly from a mobile device
- Selection of observation type (observation, shoot, collision with vehicle, death, footprint
- Number of specimens
- Sex (male, female, cub, not recognizable).
- Possibility to enter a photo
- Description of the observation

In the end, it is necessary to press, "send" to save the data (Figure 3).

Source: own processing

Figure 3: New observation forms.

As wide a public as possible is needed for this activity. A relatively large awareness has been attempted through specialized magazines, hobby web pages and in cooperation with institutions managing large areas of land, e.g. the Forests of the Czech Republic, a state-owned enterprise and the Military Forests and Estates of the Czech Republic, a state-owned enterprise. Notification via social networks will be another medium, which is now being prepared.

Data browsing

Data is available for all visitors of web pages in „Show" mode. The visitor selects the species of interest and time period of the data to be watched. After clicking "send", the individual places of the occurrence will be viewed in the map with a description of the observation.

There is a small discrepancy in historical data; in the past, names of the nearest municipalities were entered instead of GPS coordinates of single places. When entering the data in a map, the coordinates of particular municipality were used so the place of the observation is entered as a place of the municipality

For scientific use, the saved data is exported to specialized Geographical Information Systems (GIS), where it is possible to perform other analyses with respect to vegetation, altitude, population density, climatic conditions etc.

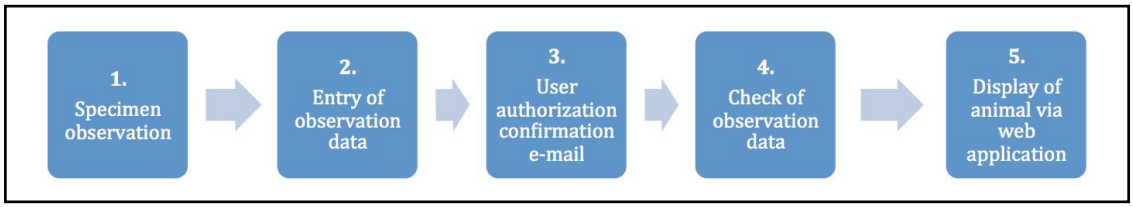
Application allows exporting data to XML (Extensible Markup Language) file by using Dublin Core metadata terms and AGROVOC thesaurus for data description (Šimek, 2013).

Data verification and approval

The entered observation data is not immediately displayed in the application. First, the user must be authorized via confirmation e-mail – the system sends an e-mail to the address entered and the user has to confirm. Authorized data is subsequently checked by the administrator of the application. Only after verification of authenticity of the observation data is the object logged into the system and displayed via online web application and utilized further (Figure 4).

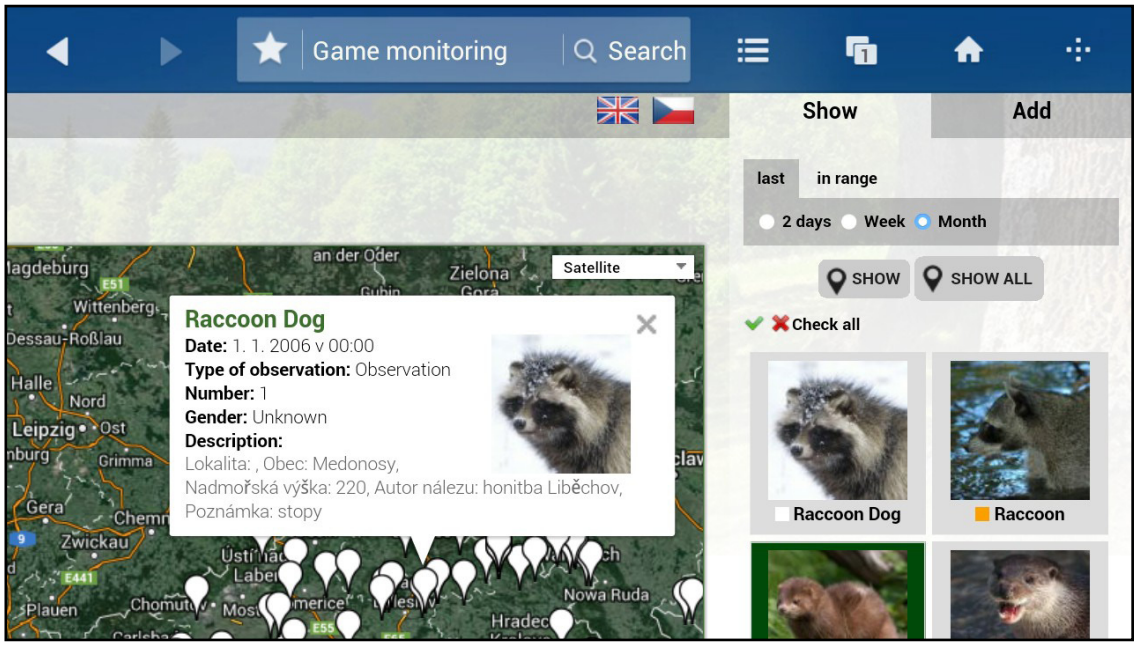
Mobile devices

Most mobile devices (smart phones, tablets) are equipped with a GPS module, camera and Internet connection. Therefore, a user application interface has been optimized for mobile devices. This application enables the entry of observation data



Source: own processing

Figure 4: Authorization of observation data entered.



Source: own processing

Figure 5: Application running on mobile device (Description: – only in Czech)..

directly into the system from the field via a single device, which enhances user comfort (Figure 5).

Conclusion

This solution is used for plotting the occurrence of protected game species within the Czech Republic. The application enables easy data entry by the general public. The data obtained is saved in the database and used for additional scientific research in other areas, for educational purposes and for the popularization of scientific research. It is possible to use this solution to record the occurrence of different species in any chosen environment. Also it can be used to monitor and display the occurrence of any object. Currently, this prototype is available in a pilot version at www.monitoring-zvere.cz.

The paper presents solution state of the issue in mid-2013. The system going to upgraded to the new version based on user feedback and comments, and further analyzes in 2014.

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