Pametna čebela - a cloud service for bee-keepers

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Abstract

This paper presents cloud based service which addresses challenges and shortcomings bee-keepers face in the process of breeding bees. The service proposes the solution for implementation of core infrastructure, concept of sensor nodes and design of graphical user interface.

1 Introduction

Bee-keeping is a long Slovenian national tradition that passes through generations. The process of bee-keeping hasn't changed significantly over the past time. The most important change is an increased demand for producing and maintaining documentation over a life span of a beehive. This is commonly done on paper, prone to inaccuracy and often incompatible with documentation from other bee-keepers.

Official Slovenian national bee-keepers' association [1] provides to its members a paper based forms for logging and managing bee related data. By law every bee-keeper is obligated to produce information on specific bee colony in his bee-house. The data include information like: bee-house location and its serial number, formation and extinction of bee colony, age of queen bee and colony, winter survival rate, date of bees first seen in the spring, treatment of varroa etc. As presented on Figure 1, collected data can sometimes be understandable only to its keeper with very little meaning to unfamiliar observer. This present a problem as bee-house data is therefore often in disordered state which is not suitable form in case of inspections, sharing data with other bee-keeper or passing tradition to younger generation.

In recent time our national bee-keeping organisation offered to its members a web application too [2]. It is very complex as it demands entering vast amount of information only about keeper. This is very time consuming and does not provide a good user experience. Aim of this paper is to propose cloud based service which provides web interface with great user experience and a way to connect keeper's sensor nodes.

2 Pametna čebela service design steps

The implementation of Pametna čebela will be divided into sub-projects. Those are: *core infrastructure*, *user interface* and *sensor node*.
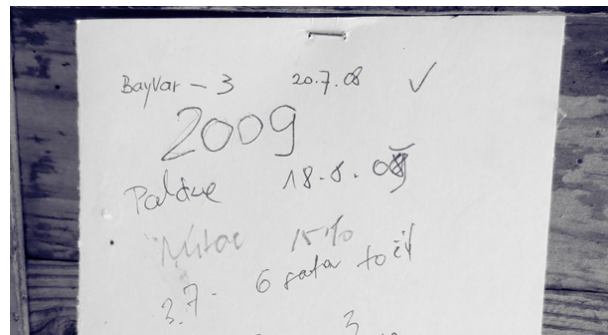

Figure 1: Managing beehive data on paper

2.1 Pametna čebela's core infrastructure

As can be seen on Figure 3, there are three service's key components: storage, application programming interface (API) and software logic, connecting them.

Storage will be implemented with combination of a relational (SQL), a non-relational (NoSQL) databases and distributed file system. SQL can efficiently do complex queries over related data such as users, bee-houses and hives. NoSQL on the other hand is good at storing large quantity of unrelated data, for instance colony records and sensor readings, providing higher I/O throughput than SQL [3]. Distributed file system will be used for static objects.

Access to cloud service will be provided by application programming interface (API). It offers language-neutral communication with service using standard RESTful HTTP calls and returning JSON data format.

When dealing with multiple users or sensors authentication and identification is required. That is taken care of by core logic. It also manages data validation and acts as a middle-ware between storage and API. Discussion is in progress about using OpenID Connect [4] as identification method.

2.2 Pametna čebela's user interface

For best user experience a dedicated user interface (UI) was developed. UI was developed for a broad group of users that vary in age and experience in operating with modern devices and applications. A simple, three tone colour scheme was selected for design with white background, orange coloured icons with black writing. Icons
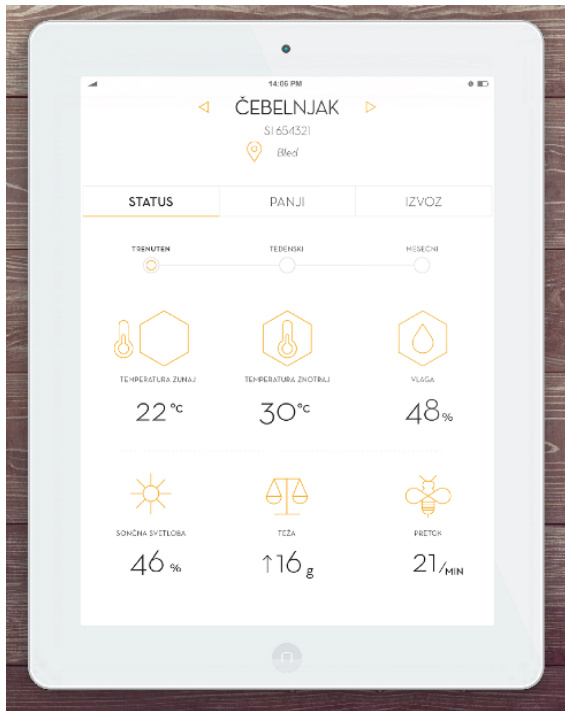
Figure 2: Pametna čebela mobile application UI

use simple graphical design which is very informative for itself. See it on Figure 2.

2.3 Sensor node

In future work this cloud service will provide user an ability to add his own sensors for measuring weight, temperature, photoelectric properties. This data can be aggregated using embedded computers such as Raspberry Pi [5], Arduino [6], etc. They can also act as a proxy or NAT-like devices for all those sensors. Current issue for this milestone is authentication and identification of those devices and sensors.
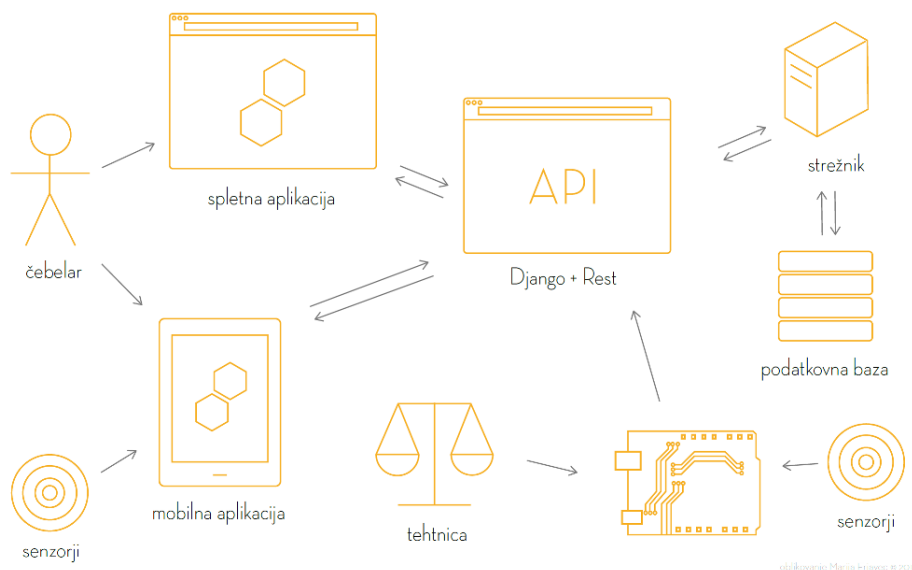
3 Conclusion and future work

The proposed cloud service is undoubtedly suitable for today's bee-keepers as it provides a new and user friendly way of managing and storing data. UI on any device will offer great user experience where embedded computer with sensors provide additional information for higher quality care of bees.

References

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Figure 3: Pametna čebela service design scheme