

An Information System for a Small Agricultural Company Built on the Google Maps Platform

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Abstract: Planning crop production is a key factor in small agricultural companies or cooperatives. The company's arable land usually consists of a number of partial plots. It is essential that agronomists keep track of what is being grown in each plot and of the state of the plot. In addition, agronomists also need to be aware of the ongoing work activities of agricultural employees. Keeping a record of what has been and is being grown in plots and across the company's land is a complex problem. Existing software solutions are not suitable for small companies and the cost of the software and associated fees is also an important factor. Information systems have received considerable attention in recent years, and Google Maps Platform appears to be a suitable tool to solve the problem of crop production planning. Google Maps Platform is often discussed in scientific articles and has already been used in many areas to solve problems related to soil, land, maps, routing, to name a few. Although there are other solutions such as geographic information systems or cadastral maps, for example, Google Maps Platform can provide crucial information and it can be used also in mobile applications. We analysed the market for information systems designed for agricultural enterprises and contacted selected agricultural enterprises. The problem domain was identified by evaluating responses in a survey. In this article, Google Maps Platform and its current use is first introduced. The article draws on a set of scientific publications referring to Google Maps Platform. Considering the results of our survey in small agricultural companies, we solve the problem using Google Maps Platform and present a proposal for an information system. The design is illustrated by several diagrams. Finally, we discuss and show how Google Maps Platform can help solve the identified problem of crop production planning in small agricultural companies. Our information system provides managerial reports and it can be easily extended with a mobile application.

Keywords: Agriculture, Google Maps Platform, ICT, Information system, MANAGEMENT, CROP production, Planning

1. Introduction

Planning crop production has a major impact on the operation of an agricultural company. Small businesses, in particular, are struggling to remain profitable and are looking for a way to effectively manage their crop production planning agenda. Typically, the company's arable land usually consists of a number of partial plots. For effective management, it is essential that agronomists keep track of what is currently being grown in each plot and of the state of the plot. In addition, agronomists also need to be aware of the ongoing work activities of agricultural employees. Keeping track of what has been and is being grown in each plot - and across the entire agricultural area (the company's land) - represents a complex challenge. Existing software solutions are not suitable for small companies and the costs of purchasing the software and any associated fees represent a significant barrier.

Agricultural companies need to have an effective and affordable tool for planning crop production. It is important for management to be aware of what is sown in each field and what state the field is in. In addition to crop tracking, managers and agronomists need to know the history of the field, what chemicals were used in the field, be informed of the condition of agricultural machinery and its use, and keep track of the ongoing work activities of employees. To address these challenges, an information system using Google Maps Platform could help agricultural companies in planning crop production. Although there are other solutions such as geographic information systems or cadastral maps, for example, Google Maps Platform can provide crucial information and it can be used also in mobile applications.

We deal with the problem of planning crop production in a small agricultural company. We conducted an analysis of the market for information systems designed for agricultural enterprises and contacted selected agricultural enterprises. The problem domain was identified by evaluating responses in a survey. In this article, we first introduce Google Maps Platform and its current use. The article draws on a set of scientific publications referring to Google Maps Platform. Considering the results of our survey in small agricultural companies, we solve the problem using Google Maps Platform and propose a simple information system using Google Maps Platform for planning crop production. This information system will be primarily used for agricultural companies or small farmers.

2. Problem Statement

We cooperate with a small agricultural company (Druzstvo Vysocina in the Vysocina Region, the Czech Republic) and we identified key problems in planning crop production in this small company. The effective production planning has a major impact on the company's operation and profit. Considering the company's profitability, the company cannot afford to purchase expensive software and operate this robust, complex system, i.e. to pay regular license fees. This company actually uses the software Excel and records the planning crop production on the company's arable land consisting of a number of smaller plots in Excel documents, tables etc. The current solution appears completely unsatisfactory.

2.1 Questionnaire

This paper focuses on crop production planning, with particular emphasis on small agricultural enterprises. The work was inspired by the practical experience of Tomas Hubeny, who subsequently addressed this topic in his bachelor's thesis (Hubeny, 2022). The main objective is to understand how crop production planning is organized within companies and how this activity is documented. To investigate this issue, we contacted five selected small agricultural enterprises in the region to inquire about their crop production planning processes.

The data were collected through face-to-face interviews, or by phone where necessary. Respondents were asked the following questions.

The questionnaire:

- How do you plan crop production?
- How do you record field history (e.g., sowing, chemical treatments, etc.)?
- Do you use any information system (software) to simplify your work?
- How do you evaluate crop production and employee work activities?
- How are employees informed about their tasks, and how do they know on which field the task should be carried out? Can mistakes occur?

In one company, we obtained several valuable practical insights. In the remaining enterprises, however, the inquiry was not successful—respondents were either unsure or unable to answer the questions. Based on the collected information, we note that crop production planning is typically carried out either in paper form or using simple digital tools such as Excel or Word. Specialized IT systems are not used, primarily due to their high cost, excessive complexity, and lack of user-friendliness for small-scale agricultural operations.

Despite the limited success of the inquiry, we were still able to gather valuable insights that were subsequently used in the design of the information system. It should be noted that the survey itself is not the focus of this article. Rather, the aim is to present the developed information system and highlight its key functionalities for crop production planning.

2.2 Existing Solutions

In order to solve this problem, we conducted an analysis of the market for information systems designed for agricultural enterprises. We contacted selected agricultural enterprises in the area (the Vysocina Region) and asked whether they use any information system to facilitate their work. We found that e.g. the WinFAS information system from WinFAS software s.r.o. is used in the region. Several other systems, namely from BM servis, s.r.o., Softbit Software, s.r.o., and Asseco Solutions, were found on the Internet. Although the systems mentioned have positive reviews, they are not suitable for small agricultural companies. These applications (software) are also very robust and many functions (provided by these applications) will not be used by agronomists. Costs of the software and other license fees are also an important factor. These applications are not free and therefore are not affordable for small companies.

The problem domain has been identified. The agronomists need to be aware of what is sown in each field and what state the field is in. The existing solution using Excel spreadsheets is no longer satisfactory. We have verified that agricultural enterprises require an information system tailored to their specific needs, rather than one overloaded with unused features.

3. Materials and Methods

Our proposal: The solution is to create an information system with a web/mobile application and to use the technology of Google Maps Platform. Other additional information related to the company's arable land

(consisting of partial plots) could be received by using Geographic Information Systems (GIS) and cadastral map data.

The importance of information systems: In today's era of information technology development, an information system is becoming a given in almost every company. It makes a lot of work easier with administration and work organization, it is clearer and can be viewed by anyone who gets access and given permissions. In the past, it was mostly accessible only from computers that were connected to a given network.

Various ICT technologies have been used for solving production problems. In recent years, we presented several innovative ICT solutions, e.g. for integration of the disabled on the labour market (Smrčka et al., 2022), improving the task administration in a production company (Musil and Smrčka, 2023), and the Dobrometr application as a tool for quantifying the economic value of volunteering (Smrčka et al., 2024).

Google Maps Platform: Google Maps are available at <https://www.google.com/maps>. To present Google Maps Platform, we use a bachelor thesis (Dohnal, 2025).

3.1 Google Maps Platform

"Google Maps Platform is a Google product that allows developers to integrate Google Maps into their pages, retrieve data from Google Maps, simple use or extensive customization. Previously known as Google Maps, it has now been updated to Google Maps Platform." (Basarsoft, @1997–2024)

Dohnal (2025) summarizes that the Google Maps Platform is a set of APIs and SDKs developed by Google that allows developers to implement Google Maps (known as Google Maps) and its components into their mobile and web applications. The platform functions are available via the Google Maps API (Application Programming Interface). Google Maps Platform functions are used through Google Maps Platform API.

Currently, the Google Maps Platform offers a wide range of various API and SDK, which are divided into four basic categories. Each category provides API and SDK that facilitate the development of applications in a given area. For the presentation, the mentioned APIs are described in detail.

- *Maps* – provide functions for displaying and drawing on maps, various geographical data on area, altitude, etc. They include the Aerial View API, Maps Elevation API, and Maps SDK for Android.
- *Routes* – allow the use of Google navigation services to calculate the fastest or shortest routes, routes between two points with a stop at another point, etc. It contains only one API, the Routes API.
- *Places* – facilitate development when working with specific places on maps. They include the Address Validation API, Places API, and Time Zone API.
- *Environment* – is a relatively new category. It contains one API, the Pollen API.

3.2 Usage of Google Maps Platform

Google Maps Platform has been widely used for several years in a number of areas and in solving particular problems. Google Maps Platform has been used for geometric delimitation of the area, especially in many areas where problems related to soil, land, maps, routing, to name a few, are solved. In this paper, we focus on agriculture, Google maps, and spatial search. Some examples of the platform's current use and its importance include, among others, the following: Map data has been used, for digital soil mapping (Padarian et al., 2015). Google Maps API is used for spatial search (Ganor, 2017), development of online map services (Hu and Dai, 2013), integration of city GIS data (Akanbi and Agunbiade, 2013), publication of land use information (Zhang et al., 2010), online mapping (Yousif and Ibrahim, 2023), (Hu, 2012), and in spatial analysis (Wang and Xu, 2011). Zhang et al. (2016) implement an API to manipulate agricultural data on mobile devices, Yousif and Ibrahim (2023) combine a map API and a database in an online mapping application. A significant area is geographic information systems (Li, 2011). Ozan Ozturk and Seker (2022) uses an API for road segmentation using deep learning. Google Maps API is also deployed in the field of artificial intelligence (Faridawaty et al., 2024), (Parvathi et al., 2025). Finally, a mobile application in connection with the Google Maps API is considered in (Hu et al., 2014; Rahmi et al., 2017; Nurwarsito and Savitri, 2018; Dores et al., 2020).

4. Proposed Solution

In our work, we need geometric delimitation areas, for which we use Google Maps Platform. We propose an information system with a web application. This paper does not focus on presenting the system architecture, but on illustrating the functions that address the identified issues and demonstrate the application of IT

technologies. The information system and its key functions are described and illustrated by the diagrams (use case diagram and data model) below. Functional requirements are as follows.

Functional requirements

- To select a partial plot from the company’s arable land.
- To view history of seeding and spraying in the plot.
- To make entries in work logs and to evaluate the work activities of employees (farmers).
- To record a task in the plot, i.e. seeding, spraying and usage of farm fleet vehicles in the plot.
- To view chemistry used in the plot and to record usage of chemistry (spraying).

The system functions are visible in the use case diagram, see Figure 1. The relevant actors are the employee and the crop production manager. The use cases are detailed (discussed) below.

Detailed description of the use cases

- In case of a problem, the employee can send a request to the administrator using the helpdesk; if he is looking for details about a given field, he searches for the plot in the map section and displays the information using a clickable image map. He has the option to search for his assigned equipment and its details. He is also able to view information about the allotted work for a certain day and, after the work is completed, writes an entry in the work log.
- The crop production manager also has the option to manage the records of fields, warehouses, assigns work to his subordinate employees and views their work log.
- The workshop manager role differs in having the option of recording equipment, but does not have the ability to manage fields and warehouses.
- The administrator has several additional functions compared to the previous roles. The main function is user management, he also generates a new economic year before the start of the upcoming season and takes care of handling user requests in the helpdesk.

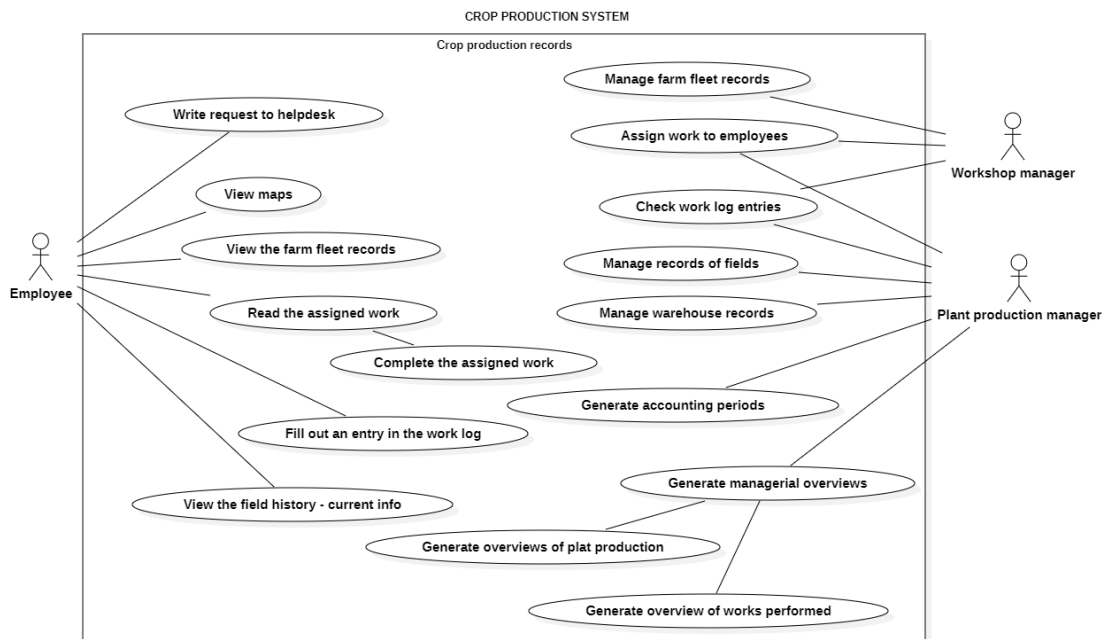


Figure 1: The use case diagram shows functional requirements

The simplified data model is shown in Figure 2. The model distinguishes types of operations linked to tasks and fields, representing a many-to-many (M:N) relationship. A task related to a plot is the main entity. It includes both *Seeding* and *Spraying*, or other agricultural activities related to the plot. The attribute *Date* is essential. A plot of the company’s fields (the entity *Plot*) is determined by the unique identifier and the geographical delimitation (received from GIS and used in connection with Google Maps Platform) is essential for mapping. *Employee* is a farmer or an agronomist. Farmers perform the assigned tasks (i.e. seeding or spraying especially) and they also edit the assigned task. They enter/input particular (agricultural) activities related to the task and finally, they complete the task. Chemicals or fertilizers are taken from the company’s warehouse and their using is recorded for the purpose of (crop production) managerial evaluation. Agronomists view the task and

they find out the history of seeding, spraying, using of chemicals and fertilizers of the plot. Our model also enables the use of agricultural machinery (*Farm fleet*).

Crop production planning is a major problem. Our model extends existing functionalities and it enables managerial effectiveness evaluations. It enables viewing the history, generating managerial overviews, evaluating of crop production, farmer performance evaluation and also the effectiveness of the usage of farmer fleet evaluation.

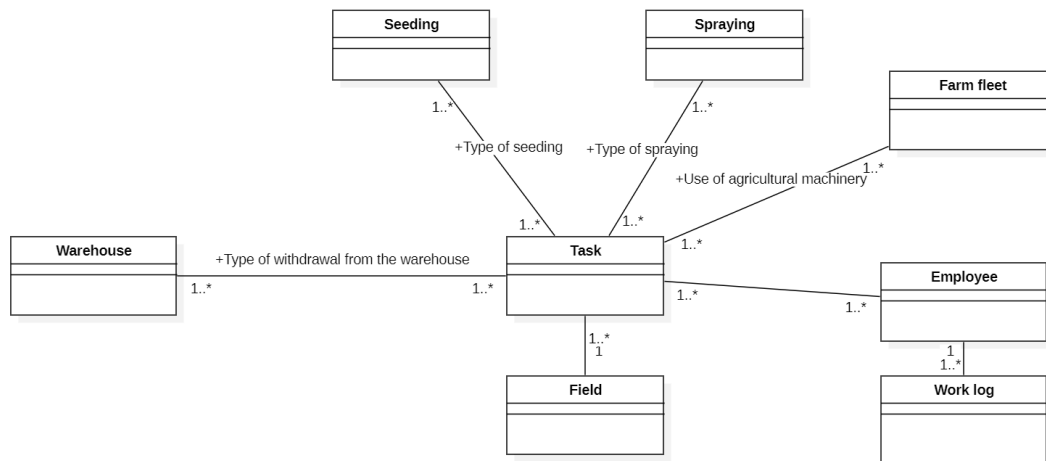


Figure 2: The high-level data model

User processes module: A login page with a functional design is displayed after logging into the system. The password is encrypted and the connection to the database is secured. The key function of the entire system is to display information about the field. After clicking on a field on the map, all information related to the given field is displayed, see Figure 3. A map module is created by downloading the current cadastral map of the selected municipality from the LPIS system. Geographic Information System is used for the geometric delineation of the plot.

Cadastral area Arnolec

Basic information:							
Cadastral number	2603/8	Field name	Suchý	The area	15:20	Sown crop	peas
Processing status:							
Date							Type
14.10.2024							cultivation
15.10.2024							sowing
15.10.2024							chemical treatment

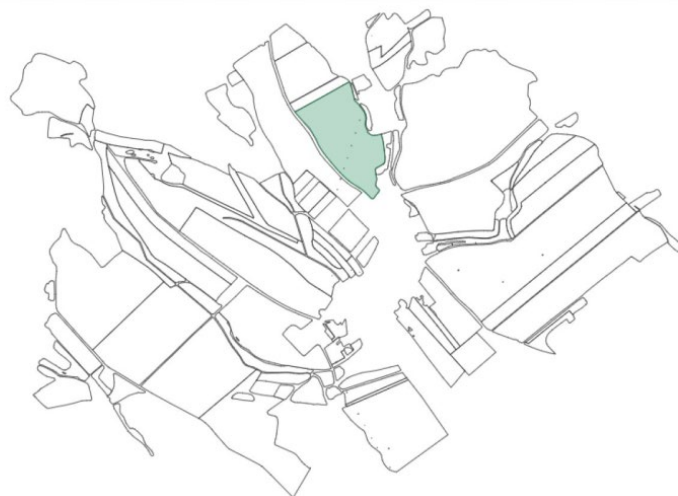


Figure 3: The maps module

5. Results

Available software solutions addressing the activities of agricultural enterprises were analyzed, and a survey conducted in selected companies helped identify the practical requirements of small agricultural businesses. An information system (web application) designed for smaller agricultural enterprises has been proposed. Its basis is field management, where information from the real estate cadastre will be available. The main function of the system is crop production management, where the agronomist records work in the fields. He records various tasks that have taken place in the field, as well as what items were used for this work. As an extension, the system offers several secondary functions: management of equipment, warehouses, employees, and a helpdesk. The system is implemented universally so that it can be used in other enterprises and perhaps it can be customized (to the needs of a specific agricultural enterprise). Our information system with web / mobile application uses Google Maps Platform.

Benefits provided by the system

- Simple and user-friendly interface.
- Offers only the necessary functions; it is not overly complex or bloated.
- Provides quick access to essential information about individual fields.
- Clear overview of each field — what is currently growing there, minimizing the risk of errors. Also shows the current status (e.g., ploughing, sowing, chemical treatments, etc.).
- Overview of employee work activities. By tracking the duration of task execution, it is possible to evaluate work efficiency.
- Helps with orientation — employees can easily identify the field assigned to them, reducing the risk of errors or field confusion.

The system's user-friendliness, its method of information delivery, and the selection of provided features all support improved efficiency in crop production planning.

The proposed information system enables management to quickly obtain an overview of the current status of individual fields and the activities being performed on them. By recording input usage and interventions, the system facilitates planning for future seasons and helps optimize operational costs. Monitoring employee activities allows for the evaluation of labour efficiency and more effective workforce organization. Precise tracking of inputs minimizes waste and enhances return on investment. Integration with Google Maps improves spatial orientation and reduces the risk of field-related confusion. The equipment and warehouse management module provides better control over assets and inventory. Digital records of activities simplify preparation for inspections and ensure compliance with regulatory requirements.

The system is designed to be universal and can be customized to meet the specific needs of individual enterprises. Web and mobile applications ensure access to information from any location, supporting flexibility and enabling faster, data-driven decision-making.

6. Discussion

Information systems for agricultural enterprises are relatively common these days. The research carried out showed that the functions of the individual systems are almost identical. They offer many functions for crop and livestock production, as well as for the administrative part of the enterprise. These functions will certainly be used by large companies with many employees and branches. These systems simplify their work and alleviate their concerns. The main disadvantage of the existing systems is the high purchase cost and the need to pay licenses. Smaller enterprises can also, of course, use advanced information systems, but they must consider the costs of licenses and possible labour costs. After consulting small enterprises, we concluded that these large systems are not a viable option for them, as many of the small enterprises do not even have livestock production and work only in the fields. The reality that a number of individuals in the enterprises are not familiar with modern trends in the sphere of ICT may also be an important factor. Moreover, information systems are often connected to mobile applications and this may not be feasible for many field workers. The proposal we are presenting has not been implemented. Our system has the potential to help small companies in crop production planning. It is easy to control and offers only basic necessary function related to the crop production planning.

Ethics and AI Declaration: Ethical clearance was not required for the research. No AI tools were used the creation of the paper.

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