



**Efficient - paperless maintenance complements and add value to the existing
maintenance process**

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SUMMARY

Maintenance information of over head lines (OHL) or substations is usually based on the use of ERP, GIS and other technical systems with partial use of paper documents. Documentation in paper is quite inefficient, which results in less detailed and less transparent work monitoring (hours, equipment, etc) and planning. Based on this information, we can say that paper based maintenance lowers the quality of business decision-making. PSA (a software named: Power Service Assistant) is a solution to the maintenance process, that supports and complements existing systems. For the purposes of planning, management and supervision of maintenance are required different documents (work order, an inventory, etc.). PSA software enables aggregation, integration and complementarily of the necessary documents in electronic form. PSA exploit new technological opportunities and offers maintainers system to support the maintenance process. The software can provide high mobility and efficiency to field teams, because it allows adequate operational even without personal knowledge of the situation on the ground. The ability of PSA software is in the connectivity to different ERP systems (Maximo, SAP), flexibility and integration with purely internal company solutions. PSA system cooperates and complements existing management information.

KEYWORDS

PSA –maintenance –new – technology – work– order – integration – energy – transmission–
OHL

Introduction

Maintenance information about over head lines (OHL) or substations, usually base on the use of ERP, GIS and other technical systems with partial use of paper documentation which is quite inefficient, and results in less detailed and less transparent work monitoring (hours, equipment, etc) and planning. Based on this assumption, we can say that paper based maintenance lowers the quality of business decision-making. Power Service Assistant (short PSA) is a solution that supports and complements existing systems in maintenance process. For the purposes of planning, management and supervision of maintenance different documents are required (work order, an inventory, etc.). PSA software enables aggregation and integration of necessary documents in electronic form. PSA explores new technological opportunities and offers to maintenance personal system to supports the maintenance process. The software can provide high mobility and efficiency to field teams, because it allows adequate operation even without knowledge of the situation on the field. The ability of PSA software is in the connectivity to different ERP systems (Maximo, SAP), flexibility and integration with purely internal company solutions. PSA system cooperates and complements existing management information.

Mobile maintenance and technology

Rapid technology development in mobile devices sector is redirecting users from paper work and personal computer to mobile technology. Therefore, companies should prepare for a new era, where mobile technology is prevailing. For modern company fundamental and most critical factors of success are timely and accurate (quality) information that can be obtained only by integrated information system (IS) with ability to connect several functional business areas in to one. Presented solution is suitable for the transmission network maintenance department, whose primary goal is to efficiently manage assets. Before implementation of presented system, Slovenian TSO (ELES) used separately a variety of technical software (Maximo for basic support, planning, management and process analysis in maintenance and Gridmc, GMS, GIS applications, Calpomain, etc.). Mentioned software products represent individual support of different process and are part of the entire technical database (which should be integrated as one). One of the key factors for successful businesses operation is to manage company's resources, and PSA application with mobile elements provides adequate, quick and easy access to information from different database. This kind of access ensures transparency, accessibility and timely information, necessary for system review or planning.

PSA project

Before submitting the PSA project, we analysed existing processes and IS that revealed the following key weaknesses: Unsatisfying connection of individual IS; Inadequate fault monitoring; Slow data transfer. After reviewed analyse report and long discussions with potential users the decision was made, that the new software must contain the following characteristics:

- Transparent and up to date data input;
- Easier and more flexible work with IS;
- Field works (maintenance personnel) should be included into process (maintenance approach);
- Transition from paper to "electronic" maintenance;
- Recording access and inspection routes and;
- Systematic monitoring and analysis of faults on transmission lines.

On this foundation (characteristics of new system) were set target project objectives: Building mobile maintenance system, Coding defects and measures if defects arise.

According to software characteristic and objectives, we developed software with the following functionality and requirements:

- Web application;
- Use of standard hardware;
- Integration with existing systems;
- User friendly - simplicity and interactivity: use of drop-down lists, minimum manual inscribing, etc.;
- Easy upgrades (modular upgrade);
- Remote data transmission;
- Fulfilling work order in the field;
- Recording defects or findings in the field (with history review);
- Coding defects, causes and measures to eliminate defects;
- Recording access and inspection routes with area orientation and;
- Making various reports and analysis of acquired data.

PSA system enables planning, realization support and supervision of fieldwork in electronic form (mobile maintenance process). The process is designed to support data preparation and transmission to the mobile unit. For fieldwork support, it also enables data transmission from the mobile unit to central computer to review updates. The process is shown in Figure 1.



Figure 1: Data transmission

Implementation of PSA system doesn't influence existing software, so all needed data are prepared in existing business and technical systems (work order, maps like laser scanning data, ortho-photo, etc., access and inspection routes, OHL technical data, etc.) and then linked together with PSA system. Working orders are prepared for specific worker (who, when and where– figure 2) and transmitted to mobile device. In the field, PSA application enables: Field orientation, fulfilling work order, recording of identified faults, record of access roads and access to technical data.



Figure 2: Preparing working order

Software solutions for mobile units are designed user friendly, so users don't enter data manually, but they can choose from the drop-down menus, with possibility to enter any description. The PSA system supports the work process so that users are lead step by step. Logging of access and routes as well as area orientation is implemented with an integrated GPS receiver. This feature enables recording road key points with description and transportability (by car, foot, etc.). Embedded failure coding system is based on codebook of existing technical software that is upgraded and modified to user's requirements with hierarchical stepwise (location, classification, cause, provided initiative to eliminate the damage and external cause for the resulting damage).



Figure 3: An application on mobile device

After fulfilled working order (on mobile device), acquired field data are transferred from mobile device in the PSA web application, where before transfer to other IS final check and adding comments is possible. Built-in database of failures allows performing various analysis and insight into the condition of equipment.

System design, hardware and software requirements

System design is shown in Figure 5. Technical data of the devices usually already exist in some other information systems; PSA system only links them together in one.



Figure 5: System design

The system is built from the following software components:

1. PSA server
2. PSA mobile

PSA server is web-based application that integrates data from various technical and business IS. **PSA** server enables (according to level access) data transfer from the CMMS/EAM system to **PSA** server (like editing code tables, lists, making checks and preparation for mobile device). **PSA** server also allows viewing and editing data from the field via mobile devices with ability to download/upload reports back to the CMMS/EAM system.

Data transfer from mobile device (**PSA** mobile) back to **PSA** server is momentarily possible via USB connection. According to customer's request, on-line transmission via WiFi, GPRS or any other connections are disabled. However **PSA** mobile design allows upgrading the remote transmission of data without major interventions in the system itself.

Conclusion

Introduction of the **PSA** mobile system for supporting maintenance process of the company represents an important step. On one hand, it links existing systems into one and secondly, upgrades the overall technical IS with advanced functionality. With **PSA** system we can improve the maintenance process, achieve greater efficiency and work quality, which indirectly reflects on lower expences.

Benefits of using **PSA** mobile maintenance system are:

- Up to date and reliable fault analysis,
- Simplifies work process and increases productivity,
- Saves time and resources,
- Up to date information - faster data flow.

BIBLIOGRAPHY

[1] Project documentation, Technical documentation and User guide for PSA Mobile System PSA