PROFESSIONAL MAINTENANCE APPLICATION V.1.0
(Smart Maintenance App)

SOFTWARE REQUIREMENT SPECIFICATION

Content

1. INTRODUCTION

For the manufacturing industry maintenance consists in carrying out all the necessary actions to restore the durable equipment or keep it in specific operating conditions. "*The very word "durable" means that the equipment is intended to last a long time and must therefore be maintained"* (Trevathan, 2018). In this sense, it can be said that the purpose of maintenance is to maximize the effectiveness of the machines and production lines.

Considering that there are different approaches to maintenance, a classification of the most accepted approaches in literature from which different types of maintenance derive is presented in Figure 1.

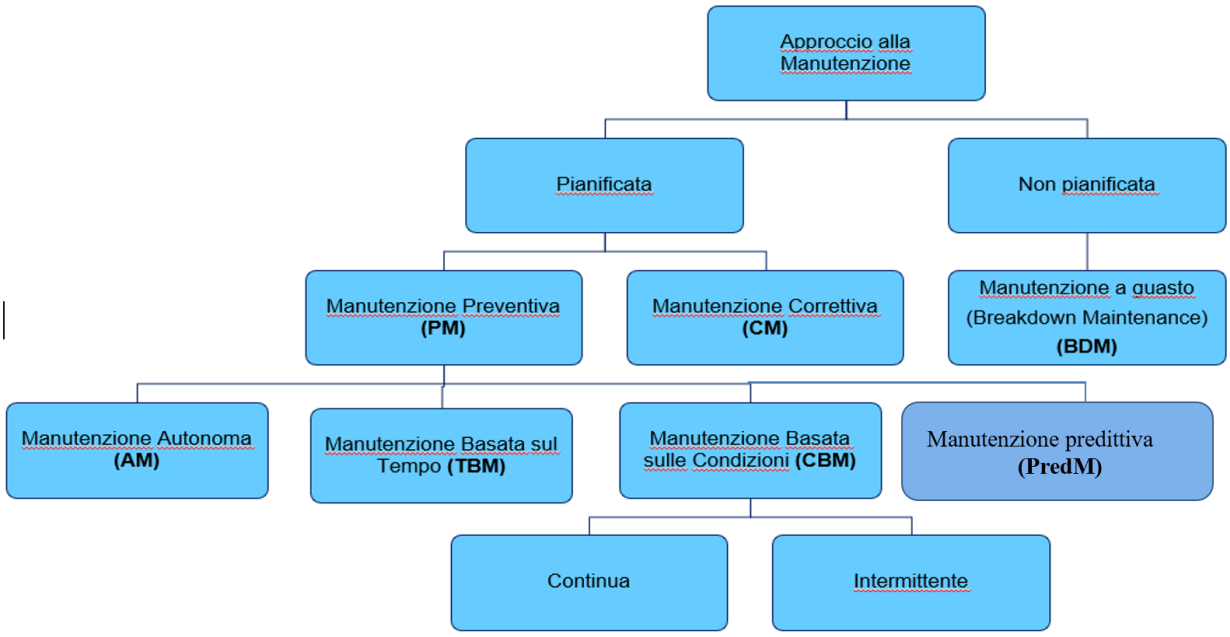

Figure 1. Maintenance types

As you can see, there are various types of maintenance that can be performed based on certain conditions or characteristics, but they are mainly classified into two categories: planned and unplanned.

The **planned approach to maintenance** provides that maintenance strategies can be broadly classified into *corrective maintenance (CM)* and *preventive maintenance (PM)* strategies, which are fundamentally based on the execution of all those activities that tend to avoid the occurrence of damage to machines and factory equipment. On the other hand, **unplanned maintenance** refers to what can intervene to repair a sudden failure and is completely reactive to machine errors.

To facilitate machinery maintenance and manage the failures presented in these company resources in a more efficient way, it is important to use IT tools that allow the management of planned and unplanned maintenance activities.

In this sense, this document presents the software requirements specification for the development of an information system that allows the management of maintenance activities through a portable data entry tool.

The application will allow the management of the following maintenance activities:

1. Scheduled activity (planned maintenance)
2. Unscheduled activity (unplanned maintenance)
3. Extra activity
4. Close Emergency Work Order (EWO)

Therefore, the application must make use of a database to record maintenance-related

activities, exposing an intuitive, user-friendly interface that supports the different roles involved in the process (***Planner, Maintainer***).

2. TERMS DEFINITION, ACRONYMS AND ABBREVIATIONS

2.1. Terms

This section defines the relevant terms for all the stakeholders of the information system to be developed and intends to unify their understanding of them:

- **Scheduled activity:** refers to a *planned maintenance activity* (see Figure 1), which must be carried out on a certain machine according to the schedule established by the *Planner* role. This type of activity can be *interruptible* or *non-interruptible*, according to the priority and type of operations that have been established. They are generally related to Preventive (PM) or Corrective (CM) maintenance activities.

- **Unscheduled activity:** refers to an *unplanned maintenance activity* (see Figure 1), which occurs at the time of execution of a machine (generally associated with a Breakdown or failure -BDM) and must be assigned for execution, according to the assigned priority.

- **Extra activity:** refers to maintenance activities that must be carried out but are not necessarily related to a damage or failure, such as changing the oil or fuel. They are generally related to Autonomous maintenance (AM) (see Figure 1).

2.2. Acronyms and Abbreviations

In this section, all the acronyms and abbreviations used in this document:

- **EWO:** Emergency Work Order, is generated when an unscheduled breakdown occurs, and an asset needs to be repaired right away. Is used to record and track any reactive work performed that was not planned beforehand. Once the work is complete, the maintenance technician can provide information in the work order about what happened, why the breakdown occurred, what was done about it, and what can be done to prevent it from occurring again.
- **SMP:** Standard Maintenance Procedure.
- **FR:** functional requirement.
- **NFR:** non-functional requirement.
- **FRDB:** functional requirements related to the database.

- **FRSA:** functional requirements related to the System Administrator role.
- **FRP:** functional requirements related to the Planner role.
- **FRM:** functional requirements related to the Maintainer role.
- **RES:** Restriction.
- **PHP:** Hypertext Preprocessor, is a popular general-purpose scripting language that is especially suited to web development[1].
- **MySQL:** is an open-source relational database management system (RDBMS)[2].
- **MVC:** Model–view–controller architecture, is a software design pattern commonly used for developing user interfaces which divides the related program logic into three interconnected elements. This is done to separate internal representations of information from the way information is presented to and accepted from the user.[3][4] This kind of pattern is used for designing the layout of the page.

[1] "PHP: Hypertext Preprocessor". www.php.net. Retrieved 2020-02-12.

[2] MySQL 8.0 Reference Manual. Oracle Corporation. Retrieved 3 April 2020.

[3] Reenskaug, Trygve; Coplien, James O. (20 March 2009). "The DCI Architecture: A New Vision of Object Oriented Programming". Artima Developer.

[4] Burbeck (1992).

3. DESCRIPTION OF THE CURRENT SCENARIO

3.1. The proposed system

3.1.1. Overview

The project aims to develop an information system capable of managing information from planned and unplanned maintenance activities, as well as those related to EWO records. Specifically, it will be a web application to provide support to the roles of Planner and Maintainer during the management cycle of a machinery maintenance process.

The software development process focuses on the idea of a user-friendly application from web or mobile (responsive) environments, as a maintenance activities management tool that contributes to the company's continuous quality improvement program. To have a better understanding of the process for which the web system is developed, the following is an overview of the maintenance management process.

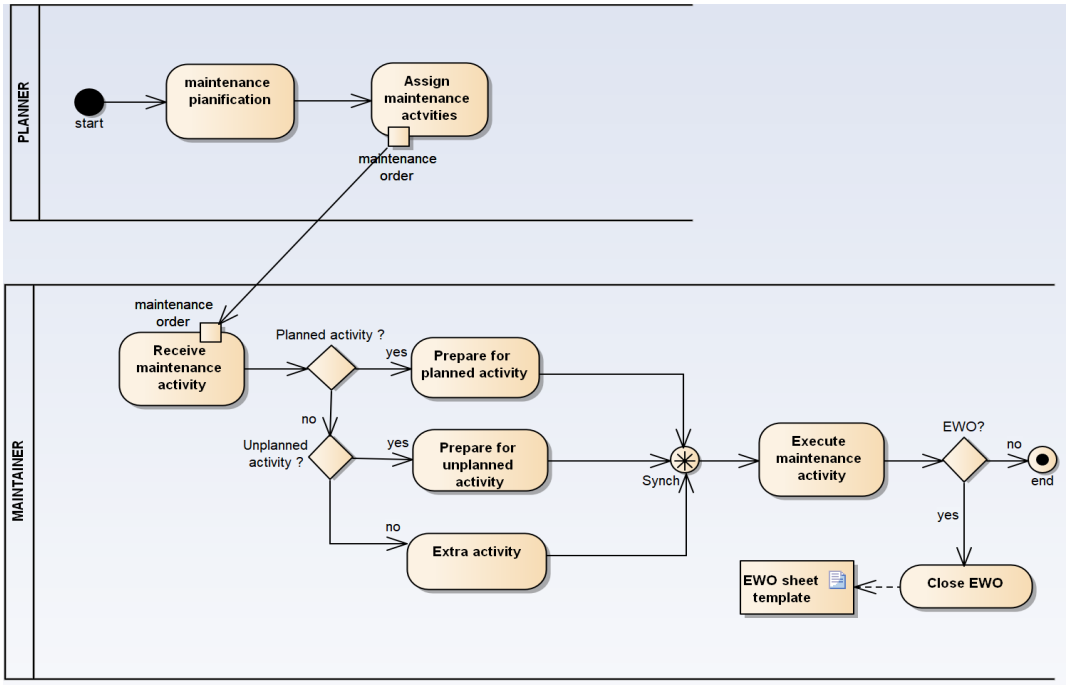

Figure 2. General Maintenance Activities diagram

3.2. Functional Requirements

3.2.1. Functions for Software configuration

The application configurability requirements refer to the capabilities that the ***System Administrator*** *role* has, in accordance with the SAx requirements, to manage the users who will have access to the system, as well as the initial information that must be loaded on the system database. Initial database load functions are described in the Repository Management RMx requirements.

Requirements for System Administrator

SA1 - User management. A *System Administrator* must be able to create, view, modify or delete system users, assign them username, password, and a specific role. The role can be:

- Planner (maintenance manager)
- Maintainer

A2 - Competence assignment. For each Maintainer role, the system must allow to assign him specific competencies.

A3 – Procedure assignment. It must be possible associate to the Maintainer the procedure to be performed according to each maintenance activity.

SA4 - Standard Maintenance Procedure. Each *Maintenance Procedure* must have associated a Standard Maintenance Procedure (SMP) file in PDF format.

SA5 – Workspace notes. The system must allow to manage (create, view, modify or delete)

Workspace notes (Optional). Those notes can be associate to a specific entity or a set of entity (e.g. area, see RM2).

SA6 Access recording. All access to the application must be recorded.

Requirements for the Repository Management

RM1 – Competence list. The system must allow a *System Administrator* to manage (create, view, modify or delete) a list of *competences related to a specific task*.

RM2 – Site list. The system must allow to manage (create, view, modify or delete) *sites*, which are composed of factory site (branch offices) and area (or department) inside the factory.

RM3 – Material list. The system must allow to manage (create, view, modify or delete) a list of *materials*, to be used during the maintenance activity.

RM4 – Maintenance procedures. The system must allow to manage (create, view, modify or delete) a list of *Maintenance procedures*.

RM5 - Competences to procedures. For each *Maintenance Procedure*, the system must allow to assign the specific competencies required to perform the maintenance activity.

RM6 – Maintenance typologies. The system must allow to manage (create, view, modify or delete) maintenance typologies as Electrical, electronic, hydraulic, mechanical.

3.2.2. *Functions related to the Planner role*

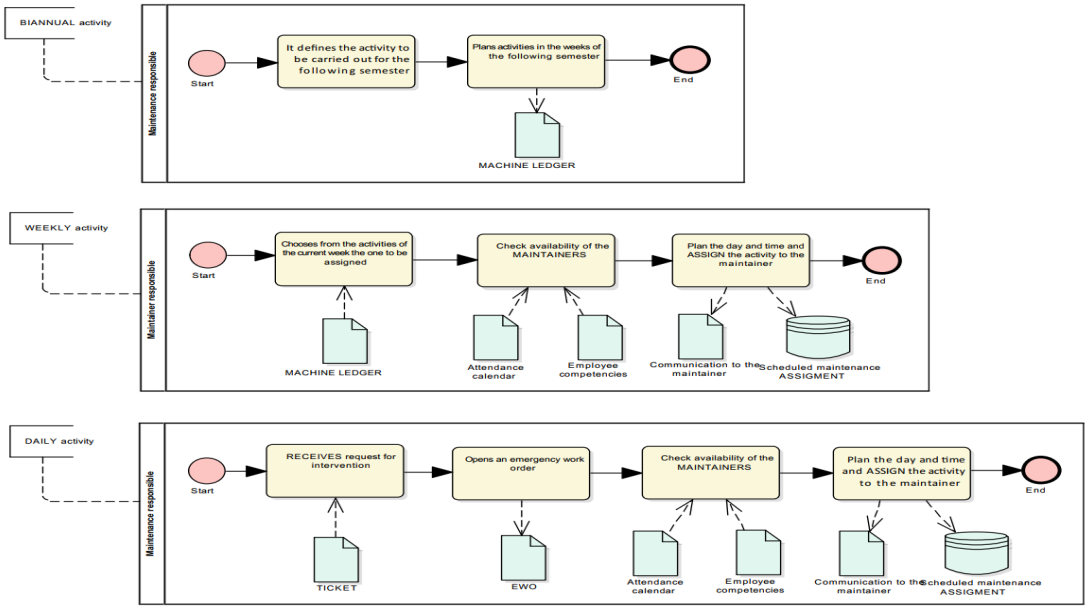

Figure 3. Planner related activities flow

A Planner can perform the following actions through the system:

P1 – Maintenance activities management. A *Planner* must be able to manage (create, view, modify or

delete) maintenance activities. A maintenance activity can be performed on a line or on an offline machine and can be:

- Planned activity
- Un-planned activity (EWO)
- Extra activity (an unplanned activity type)

For each activity the following data must be record: *activity ID, site* which is composed of factory site (branch offices) and area (or department) inside the factory, *typology* of the maintenance activity (Electrical, electronic, hydraulic, mechanical), *activity description*, *estimated intervention time* (in minutes), *interruptible activity* (Yes, No), *materials* to be used during the maintenance activity (optional), *week* (in which the activity must be carried out, between 1 and 52), *workspace notes* (optional).

Just "workspace notes" field must be editable.

P2 – Activity selection. The system must allow viewing the list of scheduled maintenance activities ordered by week.

For each activity, the following information should be displayed on the screen: *activity ID*, *area*, *typology*, *estimated intervention time*. These fields must not be editable.

Each activity must be selectable.

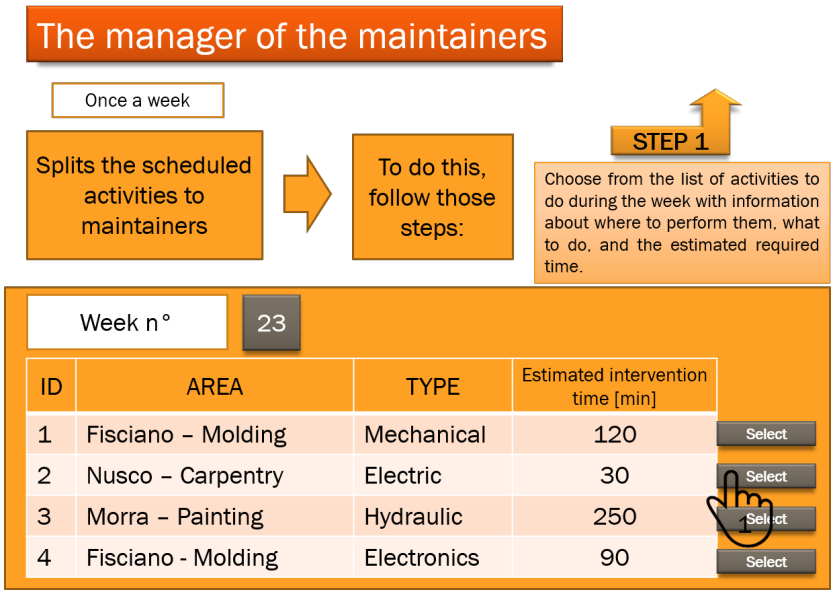

Figure 4. P2 Mock-up (TO-DO activity list screen)

P3 - Maintenance activity verification. When a Planner role select a specific activity, the system must allow to **verify** the next information: *week number, activity* to assign (activity ID, area, typology, estimated intervention time), *workspace notes*, *intervention description* (activity description), *SMP* (Standard Maintenance Procedure) file in PDF format related to the specific intervention, *competencies* (those required to perform the intervention).

Just the “workspace notes” field must be editable.

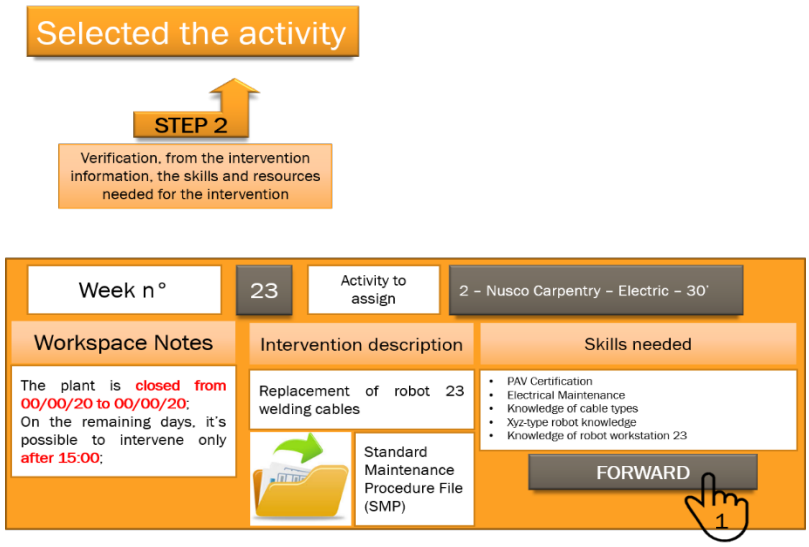

Figure 5. P3 Mock-up (selected activity information screen)

P4 – Maintenance activity assignment. Once a specific activity has been verified, the system must allow to assign the scheduled activity to a specific Maintainer, according to his availability. To do this, the system must show the following information: *week number, activity* to assign (activity ID, area, typology, estimated intervention time), *competencies* required, and the list of Maintainers with the following information:

- Maintainer name
- Competencies compliance (number of competencies achieved/required)
- Availability percentage (for each day, from Monday to Sunday)

These fields must not be editable.

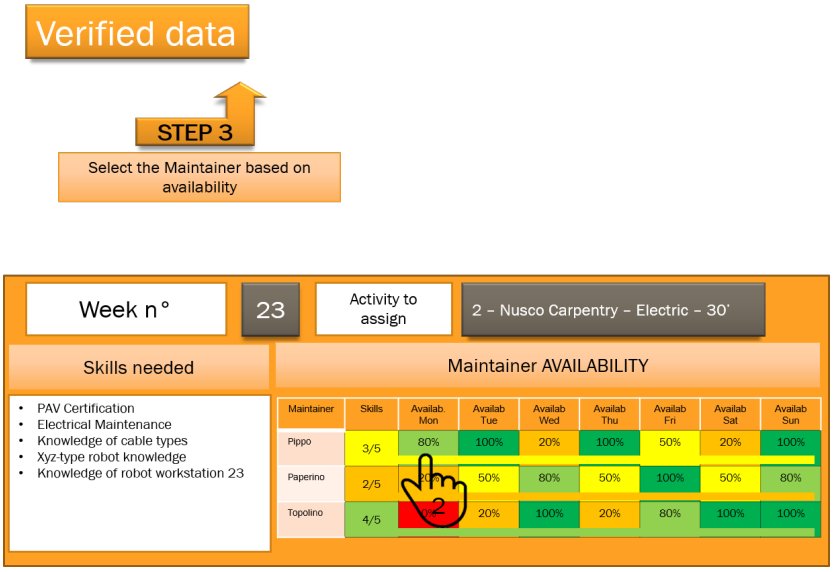

Figure 6. P4 Mock-up part 1 (Selected activity verification screen)

The system must allow selecting among the days of the week that the Maintainer has availability and show the following information: *week number, date* (selected day), *activity* to assign (activity ID, area,

typology, estimated intervention time), *workspace notes*, *maintainer name, maintainer availability percentage, maintainer competencies compliance, availability* (in minutes for each hour of his workday, e.g. 8:00-9:00, 9:00- 10:00).

These fields must not be editable.

At this point, the system must allow to select the slot of availability time (to assign the schedule in minutes) in which the maintenance activity will be assigned and program the activity.

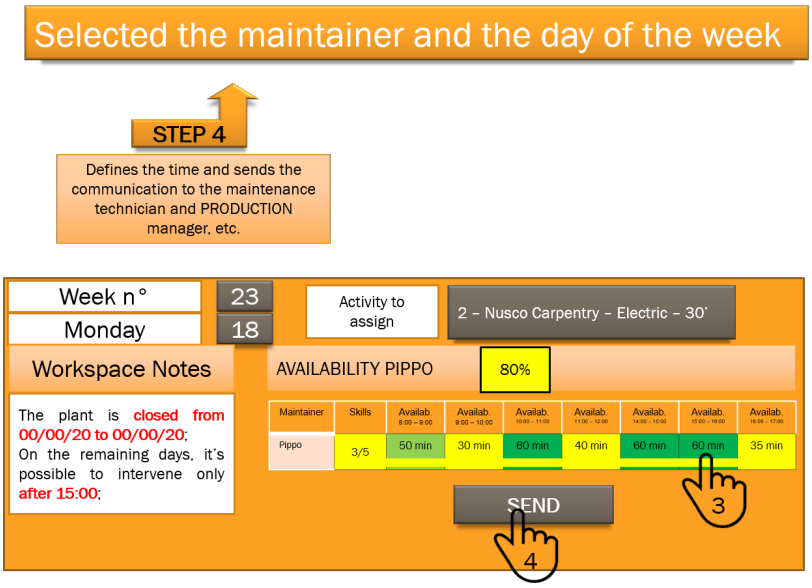

Figure 7. P4 Mock-up part 2 (Activity assignation screen)

Each Maintainer may be assigned one or more maintenance activities.

P5 – Maintenance order notification. When a maintenance activity is assigned according to P4, the system must send a notification to the selected *Maintainer* profile with a copy by e-mail to the *Production manager*.

P6 – Emergency Work Order. When a specific EWO is selected, the system must allow to verify the next information: *week number, date, activity* to assign (EWO ID, area, typology), *workspace notes, interruptible activity* (Yes, No).

These fields must not be editable.

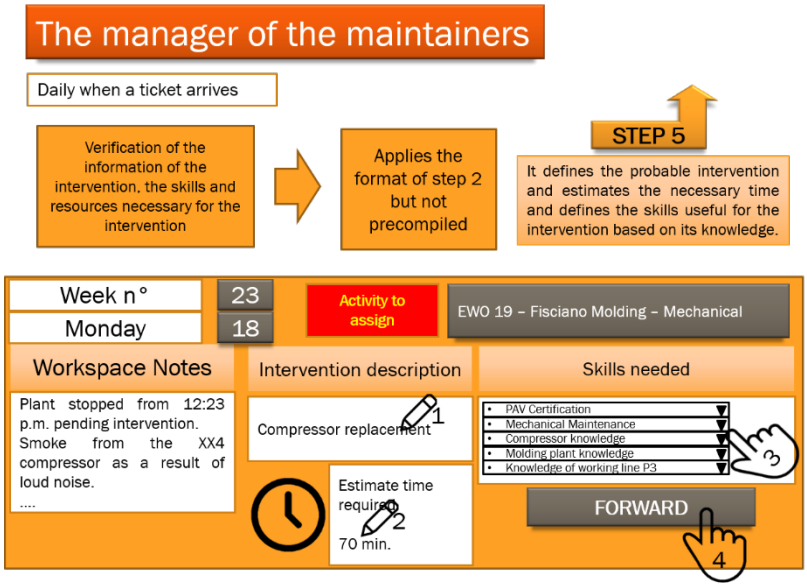

Figure 8. P6 Mock-up (EWO compilation screen)

The Planner role must be able to add the following information: *intervention description* (activity description), *estimated intervention time* (in minutes), *competencies* (those required to perform the intervention. This field must be selectable from a list of pre-existing competencies), *materials* (to be used during the maintenance activity. This field must be optional).

These fields must be editable.

P7 - EWO assignment. Once a specific EWO has been verified and filled (see P6), the system must allow to assign the non-scheduled activity to a specific Maintainer, according to his availability.

The procedure is the same presented before in P4 and P5 for scheduled activities, with the only difference that the information corresponds to the selected EWO activity.

In addition to the information shown in the P4, for the selected EWO the following information should be displayed on the screen: *workspace notes, estimated intervention time*.

These fields must not be editable.

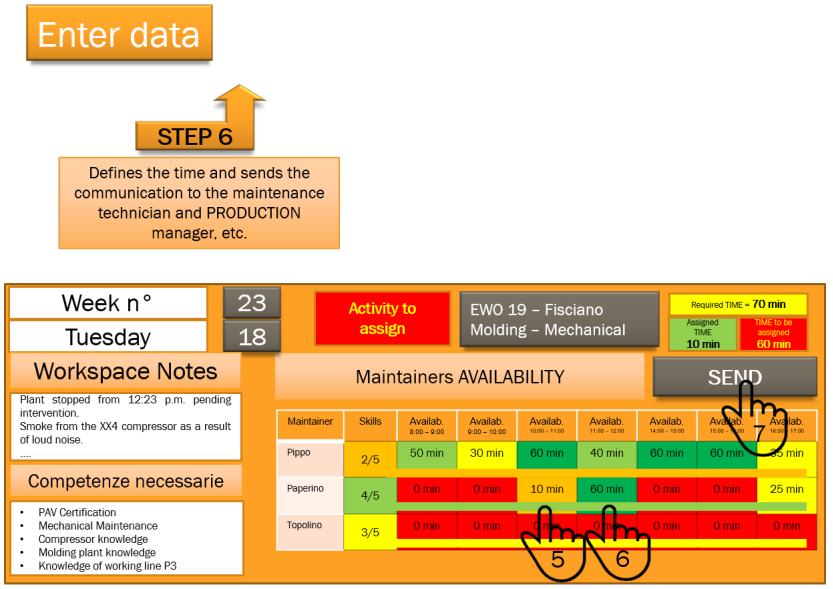

Figure 9. P8 Mock-up (EWO assignation screen)

FRP8 – interruption of current maintenance. When an EWO activity is assigned to a specific Maintainer, the activity that he is carrying out must be interrupted, as long as the activity is not **uninterruptible**.

FRP9 – Materials management. A *Planner* must be able to manage (create, view, modify or delete) *materials* needed to run a maintenance activity, as same as SA5. (optional)

FRP10 – List of assigned tickets. The system must allow the Planner role to see the list of assigned tickets (EWO). For each ticket, the following information should be displayed on the screen: *week number, date, EWO ID*, *area*, *typology*, *estimated intervention time*, *ticket state.*

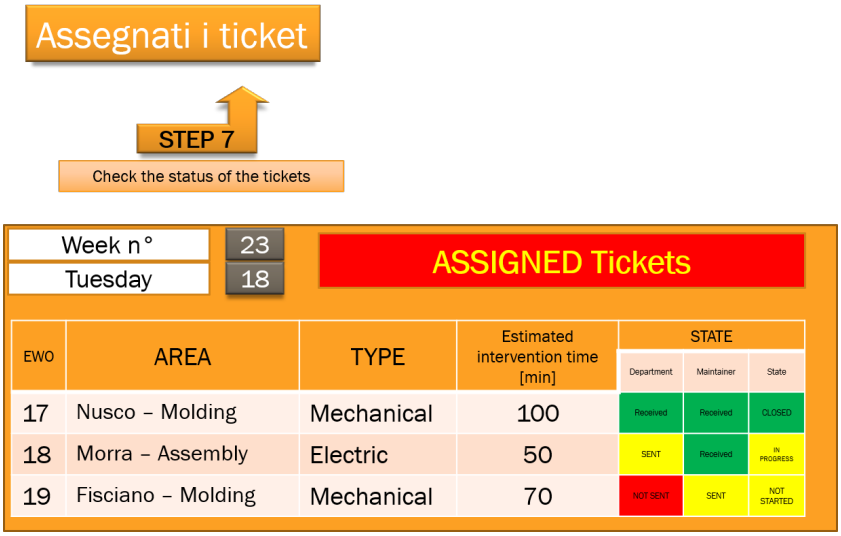

Figure 10. P10 Mock-up (Assigned tickets state screen)

The *ticket state* could be:

- For area: *received, sent, not sent.*
- For Maintainer: *sent*, *received, read.*
- General state: *not started, in progress, closed.*

These fields must not be editable.