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DEVELOPMENT OF A TRAINING PROGRAM FOR ENHANCING THE USE OF ICT TOOLS IN THE IMPLEMENTATION OF PRECISION AGRICULTURE

2018-1-ES01-KA202-050709

Practical: Tutor/student instructions

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Date: Mai 2021

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Contents

1 Objectives

The objectives of this practical session are

- Practical 1: to explain in practice how basic AS based on binary gates control or sequential logics (open/closed loop systems) work to a farmer
- Practical 2: to explain in practice how basic AS robotic system used in either livestock farming or crop farming work to a farmer. If no web resource available, imagine main sensors and actuators that are necessary to work in a more or less autonomous condition.
- Practical 3 : to prepare a multicriteria cost benefit analysis to be tested during the visits.

Note : This practical activity can be adapted in the case of university studies by using test benches, physical or simulators on more specific aspects of AS : Grafcet, PID controllers, binary logics, robotic arm simulators, etc.
Example : http://www.engineers-excel.com/Apps/PID_Simulator/Description.htm

2 Tutor/student instructions

This practical is a 5h in total and in presence. It is composed of 3 main parts :

Practical 1 and 2 are based on practical examples that have to be described and explained by students.

Practical 3 : preparation to the case study and visits through the preparation of a cost benefit analysis.

2.1. Practical 1

Objectives : explain in practice how basic AS based on binary gates control or sequential logics (open/closed loop systems) work to a farmer.

Split the audience in two groups
Using computers connected to the Web, each group will select an example of AS.

Group 1 will select an AS based on binary gates :
Objective: practice simple examples of binary gates in the domain of agriculture related, for example to spray application, irrigation, greenhouse control, …

This AS may use contactors (NO, NC) that can be activated by contact, temperature, humidity , etc.

1) Design a simple AS and identify the operative part, (sensors, actuators), and the control part
2) Design the control chart using either Boolean algebra symbols as complete as possible
3) Draw the equivalent truth table
4) Comment (advantage / inconvenient) and criticize if ever.

Prepare a PPT describing the AS and related information

Group 2 will select a, AS based on sequential logics

Objective: practice simple examples of sequential logics in the domain of agriculture related, for example, to grain storage and drying, vinery bottling, …

This AS may be studied as either an open loop automated system or a closed loop system.

1) Design a simple AS and identify the operative part, (sensors, actuators), and the control part
2) Design the control chart using simple symbols (no necessity to use Grafcet) but showing, at least, each step of the process and conditions to move forward. Association of conditions are possible through Boolean gates.
3) Comment (advantage / inconvenient) and criticize if ever.

Prepare a PPT describing the AS and related information

Conditions : Computers connected to the web, use of the lessons TP5

2.2. Practical 2

Objectives : explain in practice how basic AS robotic system used in either livestock farming or crop farming work to a farmer. If no web resource available, imagine main sensors and actuators that are necessary to work in a more or less autonomous condition.

Split into 2 groups.

Group 1: Select 2 examples of **AS found in livestock farming** (ex : feeding robot, milking robot, cleaning robot, concentrate distributor). Find relevant information to explain basic functions of the AS to a farmer. Imagine the type of sensors and actuators that allow the functioning of the robot in its environment with more or less autonomy (functionalities, limitations, adaptation to changing environment, etc)

Examples : https://www.lely.com/fr/solutions/alimentation/ (other languages possible)

Group 2 : Select 2 examples of **AS found in crop farming** (ex : weed robot, harvesting bot, pruning robot, etc…). Find relevant information to explain basic functions of the AS to a farmer. Imagine the type of sensors and actuators that allow the functioning of the robot in its environment with more or less autonomy (functionalities, limitations, adaptation to changing environment, etc)

Examples : https://www.naio-technologies.com/

Conditions : Computers connected to the web, use of the lessons TP5

2.3. Practical 3 : cost benefit analysis

Split the audience in Group 1 and Group 2

Objective : preparation of a multicriteria CBA in order to be applied during the visits.
List all arguments (pros/cros) that can be argued about AS in agriculture.
Obviously this can consider different types of AS with different levels of autonomy, etc.
Economical aspects (direct costs, undirect costs, …)
Environmental aspects (constrains/benefits in terms of pollution reduction, …
Health and Safety aspects (constrains / benefits, …)
Other items ? (confort for farmers, legal aspects …)

How to Conduct a Cost-Benefit Analysis

1. Establish a Framework for Your **Analysis**. ...
2. Identify Your **Costs** and **Benefits**. ...
3. Assign a Euro Amount or Value to Each **Cost** and **Benefit**. ...
4. Tally the Total Value of **Benefits** and **Costs** and Compare.

Present the arguments orally to the other group and debate
Conditions : Computers connected to the web, use of the lessons TP5