PROPOSE OF PROJECT FOR THE PROFESSIONAL INTERNSHIP IN THE INTEGRATION OF AN ARTIFICIAL INTELLIGENCE MODEL IN THE QUALITY ASSESSMENT OF THE WELDING SPOTS IN THE CAR BODY OF THE CARS PRODUCED BY AUDI AG, NECKARSULM, GERMANY

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CONTENT

INTRODUCTION

1. PROBLEMATIC

1.1 DESCRIPTION

Automobiles have been produced at Audi's Neckarsulm site for over 100 years. With its small- and large-series expertise and variety of derivatives, the site masters the greatest product diversity in the Volkswagen Group. Not only the Audi A4, Audi A5, Audi A6, Audi A7 or Audi A8 model series are produced here. Audi Sport GmbH (formerly quattro GmbH) has been based here since 1983. Neckarsulm also plays a key role in future-oriented projects for digital production and logistics in the Volkswagen Group and is continuing to develop into a smart factory. In addition, the Group's center of excellence for fuel cell technology is located at the Neckarsulm site. (1)

One of the most important areas within the manufacturing process is the manufacturing process of the bodywork of the cars manufactured, along which there are different points of evaluation of the quality of the welding spots applied. In order to dimension the context, we can use as an example the Audi A6, a medium size car that has around 5300 welding welding spots in its body that join its body. Considering that the mass production of these specimens makes it difficult to thoroughly check these elements, a random verification system is used. This translates into a large expenditure of resources in terms of time to manufacture a batch of cars, number of employees in the plant and quality of the welding assembly that makes up the body of one of the 150.000 (aprox.) cars produced annually at Audi's Neckarsulm plant. (2)

Currently this process is carried out by a team of specialists who perform this evaluation using ultrasound for manual monitoring of the quality of the weld at each point of resistance. As one of the pillars of AUDI, it is required to generate an improvement to this quality evaluation process, seeking not only that this process reduces its application time, but also the number of labour needed could gradually decrease, in general terms, to generate a greater digitization in the quality evaluation process that allows it to be optimized in time, quality and cost.

1.2 FORMULATION

The formulation of this problem is the optimization processing, evaluation and visualization of the production and quality data from shopfloor devices in real-time of the welding spots in the car bodies produced at the AUDI plant in Neckarsulm, using technological tools such as artificial intelligence and predictive models, mainly applied to the bodyshop of the A6 and A7 models.

Taking into account the different areas involved such as production, quality management and the digitalization department of delivery management for production and logistics, which are the source and processors of the necessary information to carry out this project.

The monetary benefit arises from the correlation of production and quality data, whereby the production and quality assurance processes can be improved and automated.

Overall benefits: reduction of production costs, reduction of the Processing time, increasing product quality, process transparency, optimized parametrization process for new products and facelifts, shorter optimization period during ramp-up phase.

2. OBJECTIVES

2.1 GENERAL OBJECTIV

General Objective: The general objective of this project is to leverage artificial intelligence and machine learning models to optimize the processing, evaluation, and visualization of real-time production and quality data from shopfloor devices for welding spots in car bodies produced at the AUDI plant in Neckarsulm. The project aims to automate the quality evaluation process and enhance the performance of AUDI cars. Additionally, the objective is to drive the technological evolution of manufacturing processes by evaluating and adjusting parameters to increase the accuracy of the AI model compared to manual evaluation results. The project also entails building comprehensive reports for stakeholder meetings to ensure project continuity and optimizing the AI model for full application in the production plants at Neckarsulm and Brussels. By achieving these objectives, the project will contribute to improved manufacturing efficiency, resource utilization, and product quality, positioning AUDI as a leader in the market while maintaining future sustainability.

2.2 SPECIFIC OBJECTIVES

- Evaluate and adjust the parameters to increase the accuracy of the IA model compared to the results of the manual evaluation.

- Build the necessary reports for the stakeholder meetings to give continuity to the project.

- Optimize the model so that it can be fully applied in the production plant in Neckarsulm and Brussels.

- To generate acceptance among the production staff in order to introduce the model into the evaluation methods on a permanent basis.

3. PROJECT'S DEVELOPMENT

3.1 METODOLOGY

There are different activities and stages that will take place during the realization of this project. In the first instance, it is necessary to generate weekly reports of the results of the artificial intelligence model, as well as the evaluation made by the specialists with ultrasound, this will serve as a basis for monitoring the evolution of both the model and the project itself. These reports are presented weekly in different meetings to all interested parties, from the leaders in the production area to the manager of the digital innovation area.

For this, it is also necessary to maintain constant communication with the leaders of the plants in Neckarsulm and Brussels (initially), since they are the ones who provide the necessary databases for the creation of the reports. In parallel, support will be given to the Data Science area in the improvement and optimization of the code base, when necessary, through weekly and biweekly meetings to evaluate the status not only of the model, but also of the quality of the data displayed in the collected databases.

Likewise, as an important part of the project development, it is necessary to generate and apply immersion plans of the new model to avoid a gap in the workers due to the rejection of the change that is to be generated, which could jeopardize the total success of the project. For this purpose, different meetings and activities are necessary in which the operation, impact, and impact of the new model are evaluated.

3.2 PROJECT STAGES MANAGEMENT

The following timeline explains in detail the different activities and stages in the time frame established for the project. At the project is expected to be developed during the internship period, the time units for the timeline are established as calendar weeks (CW), having as fulfillment of the first stage for calendar week 1 and from this, the development and completion of the project for calendar week 25.

It should be clarified that the start of the project is not given in parallel with the beginning of the internship period, which is established in this way, because

understanding the processes of the model and the evaluation process is considered as the basis for the planning and subsequent implementation of the project, then for this reason and for practical purposes, the timeline is shown from the stage of claim management, this taking account that there are grouped all the activities for training and planning.

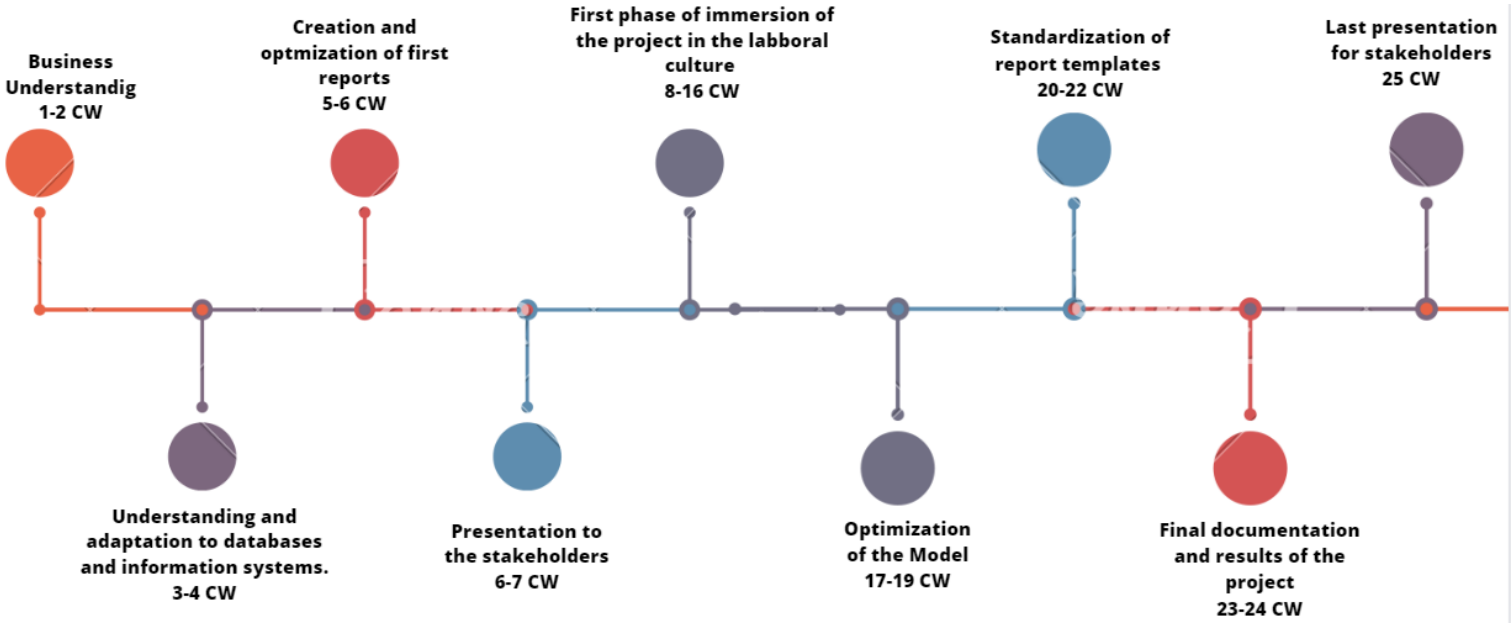

Figure 1. Timeline project stages

It is also important to mention that this initial work plan may be modified both in terms of content and application dates, as this depends on the way the project develops. In the first stage, corresponding to the first two weeks, the work is focused on getting to know in depth the project that has been carried out, the different phases proposed, the goals to be achieved, the failures previously developed, the obstacles that have arisen and the possible future risks, as well as the participants and the roles they play.

In the second stage, an immersion in the databases that contain the fundamental information for the good functioning of the model and its development is carried out, it is intended that through the work in mini projects and tasks derived from the project in general, an appropriation of the systems that the company manages in relation to this project is generated, as well as of the different databases and the information contained in them.

During weeks 5 and 6 it is intended that the creation and optimization of the first reports made by me, in this way it will be proved that the project and the central information related to it have been fully understood. This means that in the following two weeks, 6 and 7, I will be able to not only generate these reports in an automated way (using programming languages for this) but also present the reports to the interested parties in the different meetings.

As part of the project in the company, it is intended that during weeks 8 to 16 the first phase of adaptation of the IA model within the production, for this, it is necessary to generate the planning and implementation of various activities with workers to generate a good reception of this innovation and operators are willing to go through the process of change that would involve the installation of this method of evaluation within the production line.

In the middle of the timeline, between weeks 17 and 19, the effort is expected to focus on generating the crucial changes needed to the prediction model to improve its predictive quality and accuracy. This is in order to be able to put this model into operation within the AUDI plants in Neckarsulm and Brussels.

As a final part of the schedule, during the last weeks of the internship, it is intended to standardize the reports that have been created so that they can continue to be used in the future (weeks 20 to 22). Also, in the penultimate week it is required to leave the necessary documentation related to the work that has been done on the project so that it can be consulted by others after the end of the project. Finally, in the last week a final meeting with the different areas related to the project will be held to evaluate the development of the project and its final results.

4. PARTICIPATION IN WORK TEAMS

During my internship, I was actively involved in several tasks that were crucial for achieving the project objectives. These tasks allowed me to interact with different roles and positions, fostering collaboration and ensuring the successful implementation of the project.

Firstly, I worked closely with the coordinators of the production plants in Germany and Belgium. Through regular meetings, we advanced the project activities and made necessary agreements for the smooth implementation of the WPS Analytics project. This collaboration ensured that the project aligned with the specific requirements and goals of each production plant. Furthermore, throughout my internship, I had numerous interactions with the Delivery Management team in the area of Digitalization Manufacturing, Quality, and Resources. This team was responsible for overseeing the specific area where I focused my efforts. Through weekly and monthly meetings, we shared updates on project progress and discussed various points of interest related to the projects within the area. This collaboration ensured effective coordination and allowed for timely adjustments and improvements.

Additionally, I collaborated extensively with the Data Science team. Together, we focused on creating automated reports that would improve the overall quality of reports for IT projects. By leveraging our collective expertise, we aimed to enhance the efficiency and effectiveness of report generation, thereby contributing to the project's success.

In addition to these specific interactions, I also played a role in analyzing the data required for constructing the necessary graphs and generating the required reports in PowerPoint. I actively participated in the automation of report generation using programming languages, which helped streamline the reporting process and improve efficiency.

Throughout my interactions with these roles, I gained valuable insights and received feedback on the information presented in the reports, allowing for continuous improvement and optimization of the project outcomes. By collaborating closely with the coordinators, Data Science team, and Delivery Management team, I successfully contributed to the implementation of the AUDI WPS project. These interactions and relationships were instrumental in achieving the project objectives and ensuring the project's integration into the manufacturing process, leading to improvements in production and motivating the workers involved in the project at the Brussels plant.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

- Throughout my internship, significant progress was made in introducing the AUDI WPS project at the Neckarsulm, Ingolstadt, and Brussels plants. The tasks performed, such as meetings with production plant coordinators and collaborative work with the Data Science team, contributed to the successful advancement of the project.
- The automation of reports and continuous improvement in data processing and the regression model led to a weekly increase in result quality and led to the successful group wide clearance of the machine learning models used in WPS Analytics. This demonstrates that implementing advanced techniques and utilizing programming tools can generate significant improvements in IT projects.
- The frequent interactions with the Delivery Management team and other relevant areas, such as Digitalization Manufacturing, Quality, and Resources, facilitated effective communication and close collaboration. This resulted in smoother integration of the project into the manufacturing process and generated motivation among the workers.

5.2 RECOMMENDATIONS

- It is recommended for the company to continue fostering collaboration among teams from different areas, including Production, Data Science, and Delivery Management. This synergy will contribute to more effective implementation of future projects and continuous process improvement.

- Investing in training and skill development in automation and programming for the report generation team is advised. This will accelerate and enhance the quality of generated reports, streamlining workflow and optimizing resources.
- For future interns, it is suggested establishing a structured feedback system for the intern, where they can receive regular input on their performance and areas for improvement, is recommended. This will promote continuous learning and effective professional growth.

These recommendations will help the company make the most of the skills and potential of future interns, fostering a collaborative work environment and enabling successful implementation of similar projects in the future.

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