Introduction

Process Quality Control (PQC) methodologies aim to improve quality and productivity by identifying and eliminating root-causes of quality-related problems for manufacturing processes. Only for the most advanced industries, in which continuous sensors are used for monitoring, such methodologies have been developed.

It is the aim of this project to develop a PQC methodology for production processes with binary sensors, which monitor the compliance of products regarding binary features rather than controlling exact product dimensions.

Entitlement calculation

The description of the process state is based on binary features as well. To test which features are present for a new production period Statistical Process Control techniques are used. This must be based on normal datapoints in which no problems were present though.

Automated filtering of abnormal datapoints (A)

For homogeneous distributions over 99% of all datapoints lies within the indicated limits. Therefore, all datapoints exceeding the upper limit are identified as abnormal and excluded in a repetitive manner.

Case comparison algorithm

Next, a case comparison algorithm is developed based on [1] which compares a new period to all training cases of the past, yielding the most similar case. The present root-causes are then expected to be the same as those present in this reference case.

Camera tool

As a basis for this classification the training cases are diagnosed on their root-causes. Hereo, a camera tool has been developed which is triggered by the control system of the production line each time a semi-product is rejected by a certain sensor. As such, the camera makes pictures of rejects only which enables root-cause finding.

Testing at Philips Lighting Surabaya

Results

The methodology has been customized and tested for the production process of incandescent lamps. Below the percentage of correct predictions by the developed tool are presented:

<table>
<thead>
<tr>
<th>root-cause:</th>
<th>rc1</th>
<th>rc2</th>
<th>rc3</th>
<th>rc4</th>
<th>rc5</th>
</tr>
</thead>
<tbody>
<tr>
<td>accuracy</td>
<td>89%</td>
<td>92%</td>
<td>100%</td>
<td>80%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Conclusions and recommendations

The initial results show that a fairly accurate methodology has been developed. It is recommended to extend the scope to the entire production line and optimize the usability of the root-cause classes.

For other binary industries it is recommended to investigate possibilities for implementation.

References