How to adapt air sterilization to internal and external disturbances

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A popular science summary of the master's thesis "Adaptive control for an air sterilization module"

Automation is becoming increasingly wide spread and desirable in industry. Replacing or reducing the work needed to be done by humans is a good way of saving some money in the long term. However, humans are very good at adapting to unforeseen situations, so reducing human interaction and replacing it with algorithms and AI reduces the adaptability of the system. In this master's thesis this issue of adaptability has been the focus for an air sterilization module. The method developed looks at the data gathered from the machine and determines what a suitable control of the system should be. This way any external effect on the system will be captured by this method and subsequently be adapted to.

By looking at the history of input and output signals of any given system one can look at the system performance. If this is combined with a mathematical model that describes the system it can be quite simple to find a basic representation of the current state of the system. The most basic information is enough to tell us if the system has changed in some way. An example would be if the room temperature has increased, which would in turn reduce heat losses of a thermal component in a machine. We can quite easily detect this as a change in the gain of the component, and we can then adjust the control to get a more optimal machine control.
The work done in this thesis resulted in an air sterilization module that can adapt to changes in room temperature, humidity, pressure, voltage to the machine, efficiency and many other disturbances. This gives a more robust module that should be able to function well regardless of lots of varying factors across countries and seasons. This has all been done about as simple as possible, using a recursive least squares (RLS) algorithm and well known PI-control tuning laws such as the lambda-method and the AMIGO-method. The simplicity of the solution makes it lucrative as a method for many other applications.
The conclusion of this was that it is possible to increase the automation of a machine further than a more basic automatic control, without it becoming unreasonably complex. With some well known and robust algorithms and well proven rule-of-thumb equations this becomes a fairly easy-to-use method, which could have a wide spread use across many applications.