# The Human Should be Part of The Control Loop?

There is a difference between autonomy and automation. Autonomy is usually repeating the same task with no or minimal adaptation between repetitions. Automation allows the system to adapt to changes and make decision with respect to the human input. The types of autonomy are- human control, human in the loop, human on the loop and complete control.

In Human control, the human is involved in all aspects of decision making.

Human is actively engaged in control decisions for human in the loop (HIL) applications.

Human on the loop (HOL), in which human monitors the activity, takes control of the actions to be performed when the system fails or error, occurs. It is involved only for crucial agent decision making.

Complete autonomy is the subtask of supervisory control. The human has minimal task for decision making.

Failures related to the autonomous control:

HIL: failure may occur due to panic. Instability may occur when there is a communication delay and if the operator takes more time to react to the situation.

HOL: when autonomy fails and when the human supervisor cannot recover the performance.

Failures in the networked system may be due to cyber failure, physical failure and human error.

Risk is divided into two dimensions: 1. Impact of possible events. 2. Occurrence of probability of such events.

Passivity: many systems will be designed based on various levels of human autonomy integration depending on circumstances. This helps in design methodology for accessing the stability with one or more human and one or more autonomous agents that switch between exclusive controls of the plant. Applicable for ‘HIL’ performing a tracking or regulation task.

It can be concluded that autonomy can be deployed if

1. The relationship between action and consequence can be properly encoded in impact-probability matrix.
2. Estimation of system, environment and human states in a secure way.
3. The probability of negative consequences satisfies acceptable bounds.