

What is the role of a human remote operator?

Azra Habibovic | Senior Researcher at RISE | azra.habibovic@ri.se | EUCAD 2021

What is the purpose of remote operation?

- However, in a select group of particularly challenging conditions, when the SDS is unable to make a requisite decision, or requires additional guidance to do so—such as an unexpected road closure, or a vehicle blocking its exit from a customer pick-up point—our Remote Guidance capability provides human support to the SDS. A Remote Guidance Operator will assess the event and issue guidance to the SDS.
- Crucially, although the operator can provide authorization to the SDS to perform specific driving tasks it has recommended, Remote Guidance does not provide teleoperation to remotely drive the vehicle. The SDS remains responsible for planning and driving controls, including ensuring that the path ahead is safe.
- The session ends once the SDS has confirmed with Remote Guidance that the reason for the session has been cleared and has received confirmation that all tasks requiring Remote Guidance have been completed. The Remote Guidance Operator is responsible for authorizing the end of the session, and must disconnect, document relevant notes, and if necessary, forward the event to our data analysts.



- We want to bridge that gap for people by having the ability for a remote operator in the rare cases where a vehicle is stuck or in an unusual situation to direct the video game. This doesn't mean the remote operator is driving the car like in a video game; they're providing bread crumbs for decisions on whether to reroute and how to get around a blocker.
- Direct control can bring more harm than value. The tech inside the vehicle should be able to safely control it. That's because no remote connection is perfect... Instead, Yandex and most other AV companies use a type of human assistance in which the vehicle indicates that there's a problem and awaits instruction.
- Once we deploy our fully self-driving, custom vehicles, we will use a remote operator as a backup, able to take control of the vehicles and navigate them to a safe position.
- To ensure a safe operation; if an obstacle appears near the truck, the vehicle stops automatically and the transport management centre is alerted. Of the six sensors included in the system, there are always two that monitor the same part of the truck's surroundings. If a fault occurs with the truck, it can be remotely operated from the transport management centre.

cruise

Yandex

nuro



- Imagine you're out driving and you come up to a "road closed" sign ahead. You may pause for a bit as you look for a "Detour" sign to show you how to get around it or if you don't see that, start preparing to turn around from that road and create your own detour or new route. The Waymo Driver does the same thing as it evaluates how to plot the best path forward. In a case like this where the road is fully blocked, it can call on our Fleet Response specialists to provide advice on what route might be better or more efficient and then take that input, combine it with the information it has from the onboard map and what it's seeing in real time via the sensors, and choose the best way to proceed.
- To address this concern, remote operation brings a safety mechanism that allows public buses to be monitored and controlled by a remote operator from a distance, if needed. The vision of operators scanning screens and on-hand to intervene if necessary, should contribute to public acceptance of autonomous vehicles.
- Einride is publicly showcasing its one operator to multiple vehicle capability in action at a customer site. This technology sets the precedent for a future where one remote operator can take responsibility for several self-driving Pods, monitoring them when in autonomous mode and taking active control of a vehicle for unforeseen or more complicated maneuvers, such as parking at a loading dock.



Strategical

Enables the remote operator to plan trips by feeding destination goals to the vehicle.



Tactical

Enables the remote operator to help the vehicle understand and handle a given situation, as well as to provide it with guidance on how to proceed.



Operational

Enables the remote operator to actively "drive" the vehicle (e.g., when the vehicle is stuck in a complex situation).



Are we confident with this?

"Perhaps the final irony is that it is the most successful automated systems, with rare need for manual intervention, which may need the greatest investment in human operator training... I hope this paper has made clear both the irony that one is not by automating necessarily removing the difficulties, and also the possibility that resolving them will require even greater technological ingenuity than does classic automation. —Bainbridge (1983)



1. How should a remote operation center be designed to allow the operator to swap between different remote operating roles?
2. How should a remote operation center be designed to allow the remote operator to operate *multiple vehicles*?

What is the role of a human remote operator?



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What is the role of a human remote operator?

Many vehicles
Most of the time

Assessment

- Monitor and handle error messages
- Monitor tasks performed by the autonomous vehicle, e.g., reversing to the loading zone
- Communicate with on-site personnel
- Monitor several vehicles simultaneously

A few vehicles
Sometimes

Assistance

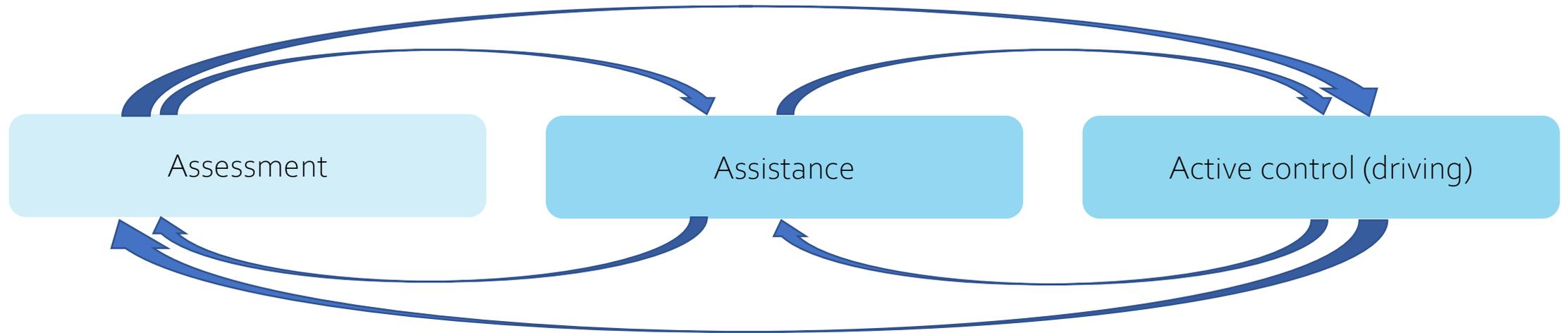
- Guide vehicle in resolving specific issues
- Fine tune vehicle control to contextual factors (speed etc.)
- Follow instructions
- Activate pre-defined missions, operations etc.
- Understand local rules and norms
- Know praxis for the given site
- Understand automated driver system's abilities and limitations

One vehicle
Rarely

Active control (driving)

- Taking over control by driving the vehicle
- Understand the context quickly to act safe and correct to solve situations
- Both critical and non-critical situations
- Requires most skill, but probably least time to practice

What is the role of a human remote operator?



Remote operator will probably swap between these roles

- Swapping between roles will require shift of focus – orientation, decide, take appropriate action – for each shift
- While human remote operator is executing active control, another operator may have to take over assessment and assistance of other vehicles
- HMI design needs to support shifting of roles
- Operator: vehicle ratio is an open question with many variables to take into account in design

Visit the virtual exhibition



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