Assured Autonomy Supervisory Intervention System Technology (AASIST)

AASIST – Assured Autonomy Safety Intervention System Technology

Assured Autonomy (AA):

Safe autonomous function in the presence of humans – Currently, autonomous operation in mining is acceptable if the autonomous equipment is sufficiently isolated from humans. Long term, this is not sustainable because it is extremely likely that humans will be required to perform maintenance and auxiliary functions in the same space as equipment. Shutting that equipment down is a significant expense and untenable in many circumstances. AA is the level at which autonomy is “self-aware” enough to actively prevent human injury.

Safety Intervention (SI):

The solution to safety in complex systems is redundancy. AASIST would be a parallel system that’s sole purpose was to evaluate its environment (digital twin) and minimize risk/cost. It would “intervene” in standard operations to avoid accidents.

System Technology (ST):

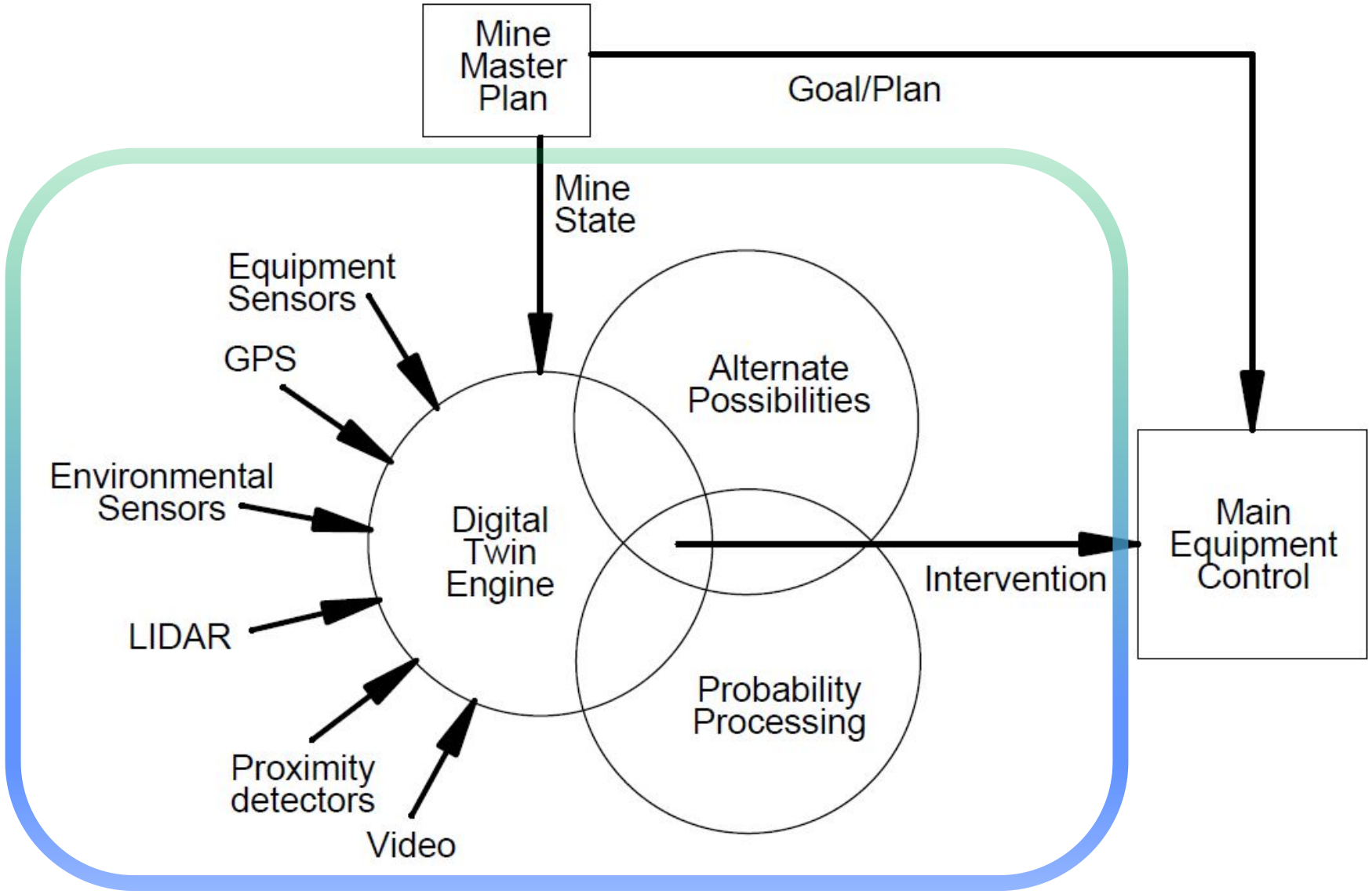
In complex systems, standard Risk Analysis (RA) is not possible. No matter how many scenarios are conceived, there is always an outlier that has not been addressed. Using a real-time systems approach, the risk can be evaluated for any set of circumstances that arises and the best solution determined using the best perspective of safety (the perspective of the equipment’s immediate environment).

What is the purpose of the research?

Project objective(s):

- Determine if technologies and methodologies exist to construct a real-time systems risk assessment and intervention framework that would eliminate the need for human oversight
- Provide a much higher level of safety and assured autonomy, based on a systems approach
- Provide a framework for equipment providers to use as a standard approach to real-time risk mitigation based on variable environmental inputs

AASIST Overview (example framework)



Acknowledgement of Facts:

- There are many companies/industries working on related technologies
- Technology is advancing faster than any one organization can keep pace with
- A "one size fits all" solution is unachievable
  - Any solution needs to be widely scalable
  - Framework must accommodate all technologies
- Standard functional safety approach is unworkable

A case study for comparison

1981 IBM creates the IBM PC with open architecture:

- Hundreds of companies started building PCs
- The common architecture enabled the growth of the PC market as it exists today
- The modern PC look very little like the original, but common architecture with coordinated modification allowed adoption of extremely rapidly changing technology.
- Common architecture limited everyone's liability and downside exposure
- Microsoft played its role in allowing easy integration of new hardware and software.

NIOSH's Potential role in the Big Picture:

- The major factor is safety – the scariest part of development of autonomous systems is liability (can it be done safely?).
- By acting as a clearing house for ongoing growth and development, NIOSH can be a third-party actor that coordinates the inevitable evolution of the architecture while providing legitimate independent research review.
- This pilot project explores the logistics of establishing that industry-wide collaboration.

What are the project's impacts?

- Proactive prevention of miner's injuries working near autonomous equipment in the future
- Reduction of current injuries and fatalities through machine intervention

Will the impact be immediate or incremental?

- Immediate for a given site, incremental broadly as adoption takes time

When will benefits be realized?

- Pilot would inform a four-year project with the goal of fostering stakeholder adoption at its conclusion. The intention would be to integrate on simple equipment to establish short term impact, then scale incrementally to the most complex equipment

How will impact be measured?

- Reduction in injuries/fatalities at sites
- Stakeholder adoption of system

Discussion / Questions

Thank you!

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