Intelligent Systems

By Marc Mailloux
&
Na'Kiya Russell

Why we chose: Intelligent Systems

- Intelligent Systems like robots will solve the most complex problems man can't solve themselves.
  - Clean/Explore Ocean, Data collection near volcanoes or hurricanes.
- Once tested and verified, they will become mainstream and will be seen everywhere
  - Automated window cleaning robots for skyscrapers, trash robots, automated mover, and so on
- The only limit would be in the physical design of the system, and the ideal autonomous robot would be able to learn using its body and perform whatever task requested.

Why HSI is important to Intelligent Systems

Using the HSI process as a guide for this new technology will help it to grow in a controlled manner and not stunt its growth

With HSI:

- Create safer systems for robot-human interaction
- Limit any likelihood of a swiss cheese errors
- Limit the ability of other to hack someones Intelligent System
- Maintain a keen understanding of the role that autonomous robots have for Humans
- Ensure that the Intelligent System is maintained in a healthy manner so it doesnt malfunction due to hardware or software

Manning

- Operator - facilitate development of system, could be A.I. researcher, or anyone trained to do so
- A.I. researchers/Programmers- develop machine learning, and intelligent system to solve problem
- Roboticist- design mechanical systems
- Psychologist- to study Human interactions, User to get data
- Marketing -market A.I. to non-users
- Statistician - pool population and distribution data
- Application Domain Experts- Experts in the domain where the Intelligent System is being applied too
- System Trainer- Train users to use System efficiently and provide feedback to developing team

MANNING RISK

1. Due to having a diverse team of people with different skill sets and experience, this may cause a risk in project strategy. The project team roles and responsibility are poorly defined, which could leave the team dynamic to not work efficiently or equal work responsibility.
2. Having different people work on different parts of the project(i.e., development, maintenance, or training), this could lead to conflicts in developing a procedure for resolving requirement conflicts. This will affect the technical design aspect.

MANNING
Measures of Performance

1. The number of deliverables/ task completed with a week's deadline
    i. This MOP is used to measure productivity of the staff we have and their ability to accomplish take in a given time frame.

2. No more than 3 failed evaluation attempts after improvements have been made to a part of the system or project
    i. This MOP is used to measure the efficiency of the staff working together and properly using resources, and manage adherences to one or more specification.

MANNING

Measure of Effectiveness

Each team member can rate each others performances on their tasks. At the end project of the project the tallied sums will generate a number for each person in the eyes of their peers. The effectiveness of the team is determined by group and individual performances on tasks.

Personnel

- A.I. Researchers will need a background in A.I. and Machine learning-Masters/PhD
- Psychologist specializing in Human-computer interaction,Masters degree
- Marketing- degree in marketing and experience handling grass roots type, plan events for more “brand awareness”
- Statistician - masters degree preferably, bachelors acceptable, experience in performing experiments
- Application Domain Experts- PhD or Expert in Domain/Area
- Roboticist-Advance degree in Robotics

KSA’s- multidimensional-multiscale analysis, training object recognition, machine learning, human-computer interaction, programing, algorithms, human-robot interaction, ontology for robotics, modeling, complex-structures

PERSONNEL RISK

1. A personnel risk would lack knowledge in a certain aspect of the project, in which it is difficult to complete a task that is required of project.
2. Team is unable to function effectively and efficiently

Personnel
Measures of Performance

1. The number complaints and customer satisfaction levels after a deliverable has be reviewed by stakeholders.
    i. This MOP is used to measure assess the operator and supporting staffs given abilities and how their skills align with tasks that are asked of them; along with process/product improvement.

2. The percentage of staff certified in the area they are working on within the project/system
    i. This MOP is used to measure the system's operator, maintainer, and support personnel knowledge.

Personnel

Measure of Effectiveness

This MOE will be similar to Manning, but this will be completely on the effectiveness of the individual. Dependant upon the personnel's task progress and goals tied along to the project. The personnel will prove effective if they complete their tasks on time, under-budget, and with in the requirements

Training

- The Users will be assessed in conjunction with a Intelligent System by assessing their essential job knowledge, skills, and attitudes
- Training will be necessary for the Intelligent System and the Human User to understand each other
- All team members need to have common general KSA’s to understand how the system as a whole
- Team members must be prepared to learn new concepts from the Application Domain Expert and Robotics & A.I. Domains.

TRAINING RISK

1. Failure to properly apply personnel properly can result in training risk involving safety issues. Unforeseen risks can appear at anytime, therefore when training employees a distinction should be made between the risk for the actual end product and risks for humans working with the robot. Training the employee or user in both cases will be essential in the effectiveness and productivity of the product.
2. Another risk is having performance measurement that are hard to interpret. If conditions aren't written properly, this can lead to insufficient training and a misunderstanding of outcome objectives for the product.

Training
Measures of Performance

1. Pass/Fail rates on training program test
    i. This MOP is used to measure and monitor the effectiveness of the training.

2. Examine the number of staff (employee) turnover rate due to training deficients.
    i. This MOP is used to measure the number of people who have departed from the project due to issues that may have stemmed from the training process.

Training

Measures of Effectiveness

The effectiveness of the Training will be dependant upon the retention rate of the personnel and their ability to take on new tasks previously trained in.

For example: The training would proven ineffective if multiple personnel could not complete a task after being training to do so.

Human Factors

Discussing Problems like:

How will Humans interact with the system?

How should the system respond?

What should it look like?

How should we perceive it? (tangible, visual haptic, auditory, digital)

Reducing bias between Humans interaction

Fail-safe

Risk Analysis

The Goal

Receive feedback to develop a better interface for the human to computer interaction.
Provide a clear understanding of the system to the user.

HUMAN FACTOR RISK

1. Erroneous coding can create human factor risk by implementing code that can has unforeseen errors, in which stakeholders and consumers will believe the product is supposed to do one thing but another result occurs which trust can be loss for the product.
2. Corrupt Humans program biases leading to further inequalities in economically and culturally

Human Factors
Measures of Performance

1. The percentage of error caused by a misunderstanding of user guidelines
    i. The MOP is used to measure potential errors that can occur from a misunderstanding of user preference and actual design utility.

2. The average time it takes for a user to complete a task compared to the predicted time
    i. The MOP is used to measure the desired system run time against the real-time, this will help account for any system lag, user misunderstanding with the system, and other complications.

Human Factors

Measures of Effectiveness

The effectiveness of Human Factors will be measured by a satisfactory unsatisfactory score. Where if a Human is injured the Human factors effectiveness was proved to be faulty. If the systems interface proves to be inefficient then of course it wouldn't be effective.

System Safety

- Designed to have small margin of error in communication between user and system
- Users have deep understand of systems functionalities and intended capabilities
- Design emergent behaviors to have Safety Protocols for example:
    - No harm to any Humans ancestor- Ideally would see that harming humans, and our environment is not suitable
    - Decide what role and control the Intelligent System vs the Human user
    - Inability to used by Humans to rule other Humans

SAFETY RISK

1. The use of autonomous systems in the establishment leads to numerous safety hazards that can end in an accident at work, because when an automatic procedure has been put in motion, it is difficult to stop it. Even if the procedure is interrupted, it cannot be ruled out that all of the risks have been averted. Since most accidents at work are caused by a lack of coordination between the human operator and the assistive system or human error (improper operation), it is essential to meet safety standards.
2. A human supervisor must know what the robot is doing in order to recognize its mistakes.260 For this reason, it is all the more important that the employee protects not only themselves from the highly developed machinery, but also protects the product from the risks of automation.

Safety
Measures of Performance

1. The ratio of potential users with/without any mental illness, chronic or acute illnesses, or lack of technology knowledge
    i. This MOP is used to measure the system's ability to be beneficial to those users who have other disabilities or lack of knowledge that need to be considered in the design of the system.

2. The percentage of usability by test trials

Safety

Measures of Effectiveness

The effectiveness of the Safety will be determined by having available the needs as necessary for those with disabilities or acute illness on the team and using the system. This will be a measure of satisfactory or unsatisfactory.

Survivability

For the System:

- If protocol is attempted to be overwritten, then system shuts down temporarily
- Back-up data is sent periodically to a cloud system in the event of hardware failure
- Strong firewalls and cyber securities to be placed.
- A Human life takes greatest importance when in danger, and refers to Safety Protocols
- Systems need to remain non threatening and corrupt free by any means
- Able to understand Users clearly

For Humans:

- Fundamental understand of the safety protocols
- Understanding of how to interact with system

SURVIVABILITY RISK

1. With automation, it will be important to properly install meaningful regulations because if not, there's a risk of increasing the speed of pollution and resource exhaustion.
2. Another risk is within the design. Depending on the outcome of the project or the effects it has on consumers isn't as desired, it will require manufacturers to re-visit the product and make adjustments.

Survivability
Measures of Performance

1. The number of maintenance and repair intervals for the systems in a six month period
    i. The MOP is used to measure the wear and tear of systems' equipment (software and hardware) and how long/if replacements of equipment is profitable.

2. The percentage of staff injuries
    i. This MOP is used to measure the number of injuries that have occurred when operation system, maintenance, and support personnel work with the system.

Survivability

Measures of Effectiveness

Parameters and conditions set in place in the event of a cataclysmic disaster. The effectiveness of the survivability will be determined by simulating the efficiency of the parameters or conditions in the event of an error in the system.

Habitability

- The system will need to be hiding in plain site to be integrated with our daily lives.
- Additionally, being able to have a unique system that has learned your comforts and habits.
- Intelligent Systems need to look and work that same as their non-intelligent system counterparts yet remain autonomous in from Humans.
    - For example a smart oven looks like a oven except I can say “Hey Oven, heat to 400F”
- Reduce remedial tasks for Humans

HABITABILITY RISK

1. The autonomous system interacting human looks to much like a “robot” and doesn't blend in with its current reality
2. The sum of Human opinion dislikes the idea of cohabitation with these intelligent systems

Habitability
Measures of Performance

1. The number of physical conditions that affect the systems performance

2. The percentage of physical conditions that the system's performance can be adjusted to.
    i. This MOP is used to measure the ability to conform the system to certain conditions.

Habitability

Measures of Effectiveness

The measure of effectiveness of Habitability will be determined by a survey that asks users if the system blends into the environment. Does the system suspend disbelief? Answering this question will aid in the measuring of effectiveness.

COST DRIVER

Main Cost Driver for Autonomous Systems will be the processing of that data of whatever industry the intelligent autonomous system is used in. For example an Intelligent System to predict stocks data would essentially be free but to be able to process all of that data is going to take a lot of CPUs which aren't cheap. Additionally the data may not be sorted in the manner you need because the data “must be easy to work with”[1]. So spending time and money on manpower to write the code to parse the data and the algorithm but also for the computing machinery if the team/company doesn't already own. Another cost driver will be the algorithms performance, as the error needs to be very low relatively to the allowed error. For example would you want to place your faith in a system that is 50% accurate? Instead 80-90% we feel a bit better, but there is still a need for improvement even at 80%

[1]https://azati.com/how-much-does-it-cost-to-utilize-machine-learning-artificial-intelligence/