TOPIC:

Intelligent Systems

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Autonomous robots or Intelligent Systems will have a huge impact on the way things are done in the years to come. Through the use of Artificial Intelligence, a lot of mundane or complex tasks will become obsolete for Humans to do. These robots will help farm lands, deliver our mail, clean the oceans, and explore the unknown. The function and look of these robots will be dependant on the task they were designed to do. The brains on the other hand will most likely be the same across most platforms of AI robots. For the most part, I see AI hardware becoming the focal point in the design requirements. Since it is a focal point, after a few iterations that design should become standardized as long as the design of course works. If the AI hardware could be standardized and open sourced, this could allow anyone to make DIY robots to solve their unique problems. It will also allow researchers to do things previously impossible or not worth the investment for some. For instance young engineers could design an automated lawn mower, a researcher could design something to help clean the oceans or exploratory data collecting robots. There are a lot of possibilities, and the need for standardization is extremely important due to the nature of the robots interacting with Humans.

Human system integration or HSI, will be an aide to the technology because its direct link to Humans. We propose, autonomous robots should be available for everyone to use, because we all have problems and we ought to be able to solve them how we please. Guidelines will be needed so that no one goes beyond what is intended by allowing the general public this use of such technology. In the development process it is important to use an HSI approach for this Human in the loop system. Specifically looking at each domain of the HSI approach, identifying those domains, the risks involved with them, and their measures of performance and effectiveness. This system decided to use an HSI approach because it allow for the creation of safer systems for robot-human interaction, fully understand the stakeholders needs and system requirements, limit the likelihood of a swiss cheese error, and ensure that the system will be maintained to protect it against hardware or software malfunctions from concept to its end of life.

7 Domains of HSI

Manning

The domain Manning deals with who will be around the system and identifying their roles. The team identified 8 main people, which are Operator, AI researchers, Roboticist, Psychologist, Marketing Specialist, Statistician, Application Domain Expert(ADE), and Systems Trainer. Each will provide key attributes for the development of Intelligent Systems, for example the ADE is extremely important as they will guide the team which data sets will be more useful. The risks associated with Manning can be defined as so: The project team roles and responsibility are poorly defined, which could leave the team dynamic to not work efficiently or

equal work responsibility. Another Risk is 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.

Personnel

The domain of personnel deals with the knowledge, skills, and abilities needed for each job. The AI Researchers will need a Masters or PhD in AI or Machine Learning, Psychologist with a minimum of a Masters degree and specializing in Human-computer interaction, Marketing Coordinator having a degree in marketing and experience handling grass roots type, plan events for more "brand awareness", a Statistician with a masters degree preferably, bachelors acceptable must have experience in performing experiments, a Roboticist that has a advanced degree in robotics, and an Application Domain Experts tha is a PhD or Expert in application Domain/Area. The risk associated with the Personnel is that a member of the personnel would lack knowledge in a certain aspect of the project, in which it is difficult to complete a task that is required of the project. Additionally the team is unable to function effectively and efficiently.

Training

The domain of Training involves the users will be assessed in conjunction with a Intelligent System by assessing their essential job knowledge, skills, and attitudes.The 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. Lastly, each team members must be prepared to learn new concepts from the Application Domain Expert and Robotics & A.I. Domains.

Human Factors

The domain of Human Factors goal is receive feedback to develop a better interface for the human to computer interaction. Additionally provide a clear understanding of the system to the user. 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). Lastly in the domain it will look at reducing bias between Humans interaction, have multiple fail-safes, and risks analysis.

System Safety

The domain of System Safety developed the design to have small margin of error in communication between user and system. Additionally for the safety of the users, they will need to have deep understand of systems functionalities and intended capabilities. Lastly the system safety will need features for emergent behavior for specific safety protocols.

Survivability

For this domain we split it in two: System Survivability and Human Survivability. System Survivability will be protocols that protect the system from being hacked or temporarily shutdown. Also having back-up data sent periodically to a cloud system in the event of a hardware failure. Additionally having strong firewalls and cyber securities, attempt to make the systems non threatening in general and corrupt free by any means, and able to understand Users clearly. For Human Survivability, the users need to know the fundamental understand of the safety protocols, and a general understand and methodology of how to interact with system

Habitability

The domain of Habitability will shape the systems, and in this cases it will need to be hiding in plain site to be integrated with our daily lives. If it is a system used by one dominate user then the systems will learn the users comforts and habits further suspending disbelief. In the beginning of Intelligent Systems, having them look and work that same as their non-intelligent system will be important to blend it into the current reality, but of course remain autonomous. If Intelligent Systems are to stick around some percentage of them will be used to aide humans in their lives.

Measure Of Performances

The five MOPs for Intelligent Systems are: (1) the percentage of staff certified in the area they are working on within the project/system, (2) the number of deliverables/ task completed with a week's deadline, (3) pass/Fail rates on training program test, (4) the percentage of error caused by a misunderstanding of user guidelines, (5) and the number of maintenance and repair intervals for the systems in a six month period. The five MOPs are related to the different to different HSI Domains by each being assigned to a specific to the domain based on the domain's concept, while measuring within our topic. For example, (1) MOP is used in the Personnel Domain, where personnel is "Knowledge, skills, and attitudes the system's operators, maintainers, and support personnel must possess"; therefore it is critical to include this aspect when defining the MOP for personnel, while keeping in mind the type of background people in personnel can possess. In contrast, (3) is related to the Training Domain. Where training is defined as "Training required to support a system's operators, maintainers, and other support personnel", thus when defining this MOP,it was important to consider what could actually measure training knowledge or lesson gained in training; therefore a test would be established to gauge this performance. (2) was established to measure productivity of the staff we have and their ability to accomplish take in a given time frame. (4) was created to measure potential errors that can occur from a misunderstanding of user preference and actual design utility. (5) was used to measure the wear and tear of systems' equipment (software and hardware) and how long/if replacements of equipment is profitable. Nonetheless, this was the same idea that was kept in mind when designing MOPs for the other HSI domains.

Measure of Effectiveness

One of the Measures of Effectiveness or MOE will be determined by looking at the end result of the system and comparing it to the requirements generated. The effectiveness of the team, and concept generation will be determined by the team use requirements and the resulting systems performs and functions as it was designed. For example the MOE would be low if half of the requirements were not met, regardless of how the system functioned. Here were are measuring the effectiveness of the use of the process, and if we don't trust the process how can one create a truly HSI system. Additionally each generated requirement is a notion of each domain element and if we don't use some then we risk the idea of not incorporating some of the domains. THis could ultimately cause a Swiss Cheese Effect.

Testing and Evaluation Plan

The T&E plan will be firstly performed by the development team. These test will be firstly the evaluation of the requirements, as it is extremely important to hit all of the requirements otherwise the product could ultimately be not what the stakeholders intended. As the process is iterated, and a new prototype is born, it will be held up against the requirements. The evaluation portion of this plan will take note of the missing requirements if any, and will report them to the design manager to then re-incorporate it back in the product for the next prototype. This process will be repeated until all requirements are contained in the final product.

The T&E plan for the MOPs will be carried out by each aspect or grouping of the team. Each team will be able to verify the outcome of each of the five MOPs. Each MOP will be tested against a threshold that the team finds acceptable for all groups, so that there is a universal standard for everyone. After a standard is set for each MOP, then the evaluation of each MOP will take place to determine the performance of the domain. For example, if we are testing for the Training MOP (pass/Fail rates on training program test), the whole team will decide on the the passing being eighty percent and above. This percentage will be used for all groups (i.e development team, system trainer). So, after training is conducted and team members are tested, the next step would be the evaluation period - the determination of if the eighty and above percentage was accomplished or not.

M&S is a critical role in the T&E process, and through M&S we are able to verify each of the requirements so that we are 100% sure that it is needed. Additionally the different requirements could be simulated to ensure that it is the right requirement needed for the task at hand. Specifically, when modeling performance or effectiveness, we have the ability to use different variants to test different conditions or minimize any potential damage that could occur in actual experimentation. M&S has the ability to keep T&E on a smaller scale that allows for use to predict and make adjustments to test before they are tested outside of M&S. Lastly through the use of M&S in our T&E plan, it allows for the product to be iterated on itself so that

the best design with the given requirements is the final product. Through M&S and HSI practices brings forth the best work possible to meet the needs of the intended stakeholders.