MICHIGAN STATE
UNIVERSITY

Human Machine Interfacing with Smart Walker Design

Application Note

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March 30th 2015
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Executive Summary

The purpose of this application note is to explain and elaborate on the human machine interface aspects of the Smart Walker design. An introduction to human machine interfacing in general is first given, followed by information pertaining to human machine interfacing specific to the Smart Walker design.

Human Machine Interface (HMI) Background

Human machine interface is an application, which presents information to the user about the state of process. In other words, this is system presents information critical to the user's desired end goal when using a device. This information can be construed in different ways, depending on how the user perceives a given device. Therefore, a variety of feedback formats may be used including visual displays, sound, haptic feedback, etc. Categories of HMI are many, however they all maintain the same concept of allowing the user to receive data from a given device. Subcategories of HMI include: direct manipulation, graphical user interfaces (GUI), web-based user interfaces, touchscreens, command line interfaces, touch user interfaces, hardware interfaces, attentive user interfaces, batch interfaces, voice user interfaces, as well as numerous others. The block diagram below (Figure 1) shows the basic structure of a generic HMI.

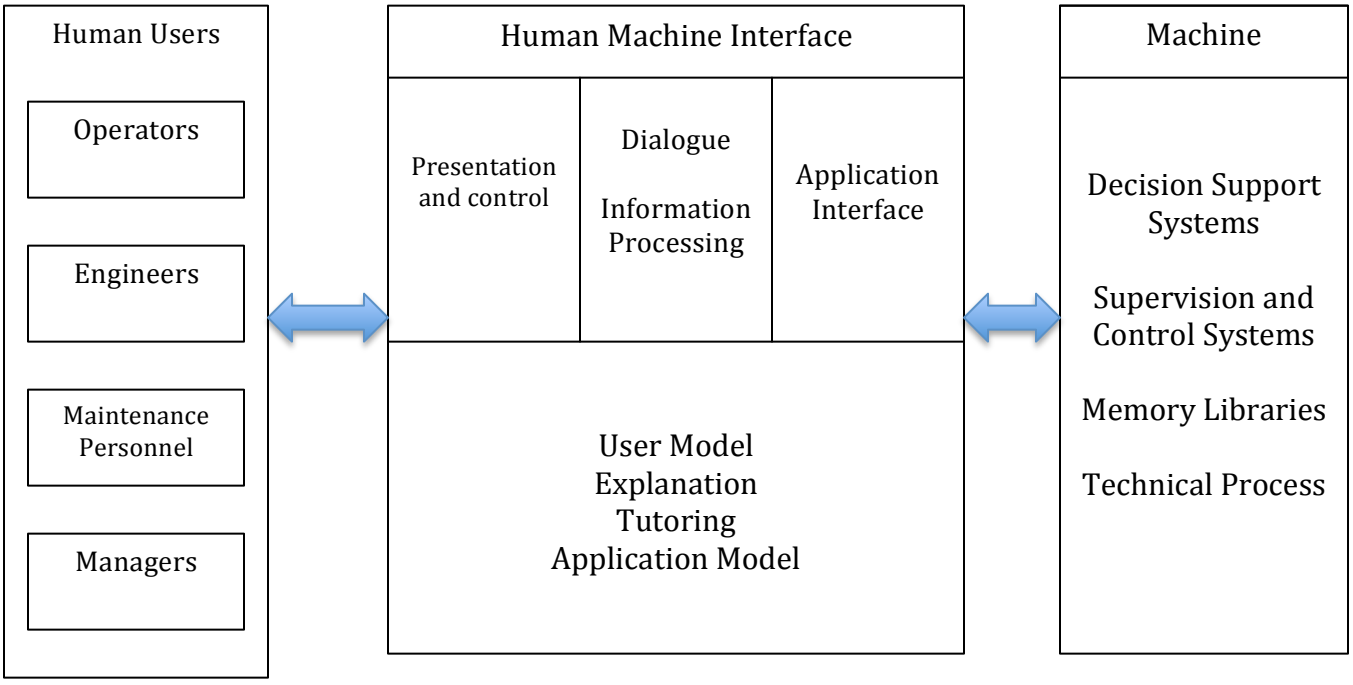


Figure 1

User Background

David is a student at Michigan State University who has visual and motoric disabilities, which affect his ability to safely navigate about certain situations. He has most difficulty with the lower, right hand quadrant of his vision, which makes detecting sudden changes in elevation or drop offs challenging. With this being said, he is still mobile but with the assistance of a device. This device is a walker, much like the model shown in the figure below (Figure 2).



Figure 2

HMI for Walker

The user(s) for this particular walker experience different interactions and perceive it differently. These differing experiences can be encapsulated by different groups of people:

Operators: The operator of this walker sees it as an extension of themself and a means for increased mobility. The handles are leaned on and serve as a support for an operator with difficulties balancing. Since the user is located behind the walker, while pushing it forward, this serves as a barrier against objects in front of them that may act as a hazard. The brakes act as an additional safety mechanism that gives the user an increased sense of security, as they can brake at a more effective rate.

Engineers: The engineers behind the design of this walker see it as a mechanical device that complements or assists in the mobility of the user. They see it as a challenge to make a singular device that can assist the mobility of users with a wide range of different situations.

Maintenance Personnel: Maintenance for this device can be handled from two different groups of people. The user of the device will be the first to observe maintenance needs and will either report them to person or group of people to maintain them, or will perform maintenance manually. If further maintenance is needed, another person or an outside group of people will see these needs and repair them accordingly. That being said, the user sees the immediate maintenance needs as their responsibility to either fix or report to maintenance personnel and maintenance personnel sees maintenance of this device as their responsibility if a user reports these findings to them.

Managers: Managers of this device would be the people associated with the branding, marketing, and selling of this product. They see this device as something that has a place in the market for any user who needs it to assist their mobility. This need encapsulates a wide range of user specific conditions and situations.

These interactions seen between each user and a generic walker include presentation, control, dialogue, information processing, and application interfaces. This is accomplished through a user model, tutoring, explanation, or an application model. The synchronization of HMI and some form of explanation, as previously mentioned, make each user specific experience possible.

HMI for Smart Walker Design

In the case for the Smart Walker design, attentive user interfacing (AUI) is utilized. This category of HMI utilizes alerts to interrupt, or warn, the user by relaying a message given certain set of circumstances. In this case, the user will be most attentive to an auditory alert; this will be the form of feedback seen for this design. This will be accomplished using a module which has been mounted to a bar custom fabricated for a preexisting, commercial walker (Figure 3,4).

The user(s) for this particular Smart Walker design experience different interactions and perceive it in differently. These differing experiences can be encapsulated by different groups of people:

Operators: Operators see this device in a similar way they see the generic walker. Where this differs is the increased level of security the user feels. Due to the feedback given to the user when hazards approach, they have further confidence and mobility when using this walker.

Engineers: Engineers see this device as a module, which is added to a generic walker for further user safety. They have designed this unit with people of severe disabilities, as well as elderly people in mind. The largest challenge engineers have seen with the development of this unit is to make it completely reliable, under all circumstances, in order to ensure user safety.

Maintenance Personnel: Maintenance for this device can be performed by two different groups of people. The user of the device will be the first to observe maintenance needs and will either report them to personnel, or will perform maintenance tasks manually. The most common form of maintenance performed by the user will be to keep the unit powered and to charge the power supply regularly. If further maintenance is needed, especially if something is technically malfunctioning, another person or an outside group of people will see these needs and repair them accordingly. That being said, the user sees the immediate maintenance needs as their responsibility to either fix or report to maintenance personnel and maintenance personnel sees maintenance of this device as their responsibility if a user reports these findings to them.

Managers: Managers of this device would be the people associated with the branding, marketing, and selling of this product. They see this device as something that has a place in the market for any user who needs it to assist their mobility, especially persons with severe disabilities or elderly people. This need encapsulates a wide range of user specific conditions and situations.

These interactions seen between each user and the Smart Walker design include presentation, control, dialogue, information processing, and application interfaces. This is accomplished through a user model, tutoring, explanation, or an application model. The synchronization of HMI and some form of explanation, as previously mentioned, make each user specific experience possible.



Figure 3



Figure 4

References

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