EECE 5552

Assistive Robotics

Assignment – 1

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Problem 1:

(a) Solution:

The five principles of assistive technology service delivery are as follows:

1. An AT service process must be person-centric:

   Any Assistive Technology must be developed having the end user's comfort in consideration. AT should be user-friendly, easy-to-learn and adapt tech that would meet the end user's needs with simplicity and joy. Having a simple learning curve for the user would be an important consideration. We would also need to keep in mind that user's can be very diversified with their age, gender, literacy and mental health. Hence, developing products that suit all of them and make anyone use the product for their benefit with ease is very important.

2. Enablement of participation in desired activities:

   Any AT technology service must have flexibility of adjusting to multiple needs of the end user. For example if a person with walking disability is been introduced to mobility wheel chair AT, it must have the flexibility to adjust for various environments such as, movement in flat grounds, high slopes, work environments, stairs and suction to the elevators in shopping centers etc.

3. Evidence- informed process needs to be used for AT servies:

   The AT's have to be tested thoroughly to gather evidence over their outputs. They need to be verified on how well they work and what are their capabilities to solve the needs of people with disabilities.

4. AT service delivery must be provided in an ethical manner:

   Maintaining a fair and ethical relationship with the user's are important. For example, if there is an assistive technology developed which collects different kinds of information from the user through sensors to predict his health condition, the user has to know clearly about all the information that's been gathered and also, what is being done with the gathered information. Confidentiality must be maintained about the users conditions. All kinds of disadvantages that come through continuous usage of the AT provided have to transparently laid down to the user well before in hand and have their consent.

5. Sustainable Service:

   AT services need to be delivered in a sustainable and timely manner. Regular updates need to be provided based on the user's feedback and modern issues. Regular repairs and servicing the AT instruments are important to have a check if they are functioning as per the description or if there are any issues over wear and tear etc. Continuous and immediate customer support needs to be provided for the people whose lives are highly dependent on these AT's.

(b) Solution:

Assistive Device: A Smart watch that can recognize what others are speaking and live transcribe it in ASL sign language symbols to deaf people.

Activity: Learn what others are speaking in the proximity.

Context: On a daily basis, in all situations, to understand others verbal communication.

Human: Deaf Person who cannot hear anything from birth. But can see and interpret ASL language very clearly.

Assistive Technology (AT): A Speech recognition system that recognizes the speech to text. And a Computer Vision network that converts text to ASL sign language symbols and displays that on the watch.

Additional Context: Some environments could be noisy, hence a speech recognition system should be robust to noise. Also, some words might not have ASL sign language symbols which could lead to misinterpretation of words. Hence, a AI trained robust system needs to be included that can avoid the potential errors in sentences to make complete sense.

Problem 2:

(a) Solution:

1. **Equitable to use:** AT should be able to be usable by wide range of people. Some products like speech recognition systems can recognize only English limiting the product to only English speakers.
2. **Flexibility in use:** AT services should be able to use in variety of environments. There are prosthetic leg developers that are made for only flat grounds. Users who use these would face trouble climbing slopes etc.
3. **Simple and Intuitive use:** Using sophisticated ML to optimize speech recognition and allowing user's to train and customize their own language for future is a feature that can

be given, but this would take away the simplicity from the product making the non tech users uncomfortable in their use.

4. **Perceptible Information:** There are many wearable devices made for people with disabilities. Nuralink is one of the buzzing product where a prototype for a chip to be inserted in brain for understanding brain signals is being done. This information could be misused/taken from user unwillingly etc in many ways without the user being known of the danger.
5. **Tolerance for Error:** Error tolerance is very important in AT devices. The same example above with Nuralink, if any parts of the device melt down in the brain, that could immediately lead to the death of the user.
6. **Low effort:** There are wheel chairs which would need a manual wheel turn by the user with his hands to move. Driving this wheel chair on slopes is a very hard task. Hence, automating such chairs with motors would make it easy for the users to handle.
7. **Size and Space for approach to use:** There are hearing aids in people that I have seen which are heavy and large in size, not letting the user have a tight grip leading the device to slip every now and then.

(b) Solution:

Internet of Things (IoT) connects all the devices in the classroom thereby enabling the students a lot of benefits to combine information's to one note, that can used to learn in the future. For example, say we have a manual paper which has an important formula and there are a few important notes the professor is explaining. One could use an IoT device like scanner to scan the formula into text and add it to your iPad notes along with what the lecturer mentioned. In the same way, the audio of the professor can be recorded with timestamp, such that you would know what notes you wrote down when the professor was mentioning something in a timely basis.

Also, using IoT blackboards and platforms in the class would help the students to directly copy whats written on the board into a pdf and store with their personal notes along with it.

IoT devices also help us keep a track of all the activates done. The amount of time studied, notes written and logistics such as reminding to charge the devices etc, which could eventually develop a healthy and hygienic environment to learn better. It also removes all other minor concerns such as charge/alarm etc and lets us concentrate on the important issues at the class.

During times like Covid, it helps people maintain social distancing without compromising the learning experience. We could use connected devices to learn, watch and virtually talk to the professors with ease from the interconnected IoT devices.