The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult as establishing the detailed technical requirements, including all the interfaces to people, to machines, and to other software systems. No part of the work so cripples the resulting system if done wrong. No other part is more difficult to rectify later. [Brooks, 1987]

I. Summary

As people get older, they tend to experience such difficulties as hearing/speaking/vision/memory loss, and/or muscle weakness. Among other things, Augmentative and Alternative Communication (AAC) is a branch of study to assist or help people with communication difficulties. It comprises of many techniques including sign language, gestures, visual aids, pictures, symbols, text-to-speech electronic communicating devices and so on. It was aimed to help people who only had difficulty in speaking or speaking clearly - to communicate. It has found many potential applications in helping people with development disabilities, speech and hearing disorder, autism, dyslexia, aphasia, and so on. The same technique can, however, also be modeled for the elderly people who have difficulty in communication. To help the elderly or the disabled having more than just speech disorder, it is necessary to go beyond the current realm of AAC, to identify all the physical and mental disorders and provide a means or a way of alleviating them.

With so many devices, such as communication boards and hearing aids, which not only prove costly but are also bulky and difficult to use (not to mention their bad aesthetic appeals), the user has been looking for a better solution. The recent advent of mobile communication and a whole new market of mobile applications make the use of new generation touch-screen cellular phones, an excellent platform for hosting such an application. It claims to be a cheap and yet an ‘easy to carry and use’ solution.

This project is intended for helping the elderly population suffering from communication difficulties, such as lack of hearing, speech impairment, unclear speech, low vision, weak memory, etc. to communicate in a better manner. So, it expands from the initial definition of AAC which is to deal with speech disorder, and takes into consideration the elderly or the disabled who suffer from speech, hearing, memory and/or vision impairment up to varying degrees. Many software vendors are eager to offer such a system. This project is also intended for helping people with muscle weaknesses, which could lead to (frequent) falls. In particular, HOPESoft, Inc. aims to pioneer such an application in this highly burgeoning market.

The company has gathered some initial requirements from potential customers and past studies and statistics. However, the company is well aware that they haven’t yet clearly characterized what their
customers really want, not to mention who their real customers might be. Consequently, the requirements definition is only preliminary, sketch, imprecise, incomplete and possibly inconsistent. It is also well aware that getting the right requirements the first time will be the barometer to successfully completing the entire development effort, reducing market release time, and to establish its reputation and ultimately to satisfying their customers.

Due to this criticality, HOPESoft, Inc. is looking to a renowned consulting firm for help. As requirements engineers of the consulting firm, you are to deliver a detailed requirements description which captures real customers’ real needs/wants as precisely, concisely and conceptually as possible.

Your team is to consider some part of the HOPE system, as described in Section II, most likely with a much narrower scope and smaller number of features.

II. HOPE (Helping Our People Easily): Preliminary Definition

II.1 The Domain, Stakeholders, Functional and Non-Functional Objectives

In the application domain, the communication typically consists of the following people and events/situations:

An elderly with speech, hearing, vision and/or memory loss stays either in a home (living alone or with a family) or in a hospital/nursing-home setting. The daily living activities like washing, taking a bath, going to the restroom, eating/drinking, walking, transferring to the bed, are the typical activities that are of concern to them and they often have to call/communicate to people around them for fulfilling these.

An assistive person is one that is either a disabled person or a non-disabled person with whom the user wants/needs to communicate. This person responds to the elderly requests and sometimes also initiates conversation about a topic or an activity like going out to eat.

The elderly frequently communicate using common greetings like hello, bye, nice to meet you, sorry etc. along with basic questions like 'What is your name?', 'Where am I?' and so on.

In a typical scenario, where a person wants to communicate a message to the elderly having hearing loss and a weak memory, he/she uses visual aids like pictures and icons and text and/or speech on top of it, to reinforce the meaning of an item – say showing a sign or picture of a restaurant, along with the name of the restaurant and saying the name loudly, to indicate the place where they will go out to eat. The elderly, on seeing the picture, recognizes the place as it is difficult to remember the name of the location.

It is learnt that human perception is visual rather than only textual and the mind functions best when all senses work in a complementary manner. This increases the necessity to provide multi-dimensional vocabulary like icons, pictures, sound, speech, text, sign and so on.

Apart from the basic communication messages, the elderly also want to perform other activities or express an opinion about something like – 'I want to watch Television', 'I want to drink Cola', 'I am not feeling well' and so on. The elderly should initiate communication by navigating among various categories. A category is a descriptor containing the multi-dimensional vocabulary items having a similar meaning, relation and/or purpose. A disjoint category is one that does not have its items overlap with any other category. An overlapping category is one that has one or more of its items overlap with items in other categories. Categories can be either activity-based or item-based at the root level e.g. items as in 'Food', 'Drink', 'People' etc. and activities like 'I want to eat', 'I want to go' etc.

An important part of elderly communication is handling emergency situations. It is more often the case that elderly living alone require prompt medical attention in cases of health emergency as well as quick response in cases of fire, theft etc. The system must be capable of providing an easy interface for emergency calls like 911, to any emergency contacts, as well as send fast messages to a nearby response department like a hospital.
Just like the elderly user, the system should be easily usable by the assistive person, e.g. by providing a good search interface through which that person need not know the entire system and can bring up any part by just visiting the search page. A sentence should be generated by a minimum amount of navigation of the system.

A real life problem describing the application domain can be found in the ‘scenario’ presentation on the course web-site.

II.2 Software System Requirements: Functional Requirements
The purpose of HOPE is to provide a platform for helping the elderly, the disabled – having unclear speech, hearing loss, weak vision and/or memory loss, in day-to-day communication. This platform shall assist the users in their communication by:-

- Providing a way for the users to select proper categories and navigate through various dimensions of vocabulary,
- Generating desired sentences and represent them pictorially as well as associating them with a sound/voice,
- Placing emergency calls and messages, possibly after detecting a fall,
- Giving a specific meaning to each picture to reduce the ambiguity, as a picture can be worth a thousand words and a thousand interpretations,
- Making each vocabulary item available through a search interface,
- Allowing to change the orientation/display of the vocabulary in terms of colors and icon size,
- Integrating already available technologies like alarm clock in a meaningful manner,
- Displaying relevant or most frequently used items before other vocabulary items,
- Making a previously generated sentence repeatable without regeneration,
- Possibly utilizing barcode or QR code reading capabilities, as well as such techniques as GoogleGlass,
- .......

Overall, the system should also make the vocabulary organization such that the user can use it in many contexts and sentences are generated in fewer clicks.

II.3 Software System Non-Functional Requirements
In the assistive communication device/application, in addition to the functional requirements, non-functional requirements should also be taken into account. They include:

- The system should be usable;
- The system shall be ubiquitous;
- The system should be quick to understand (the learning time should be very low) and very easy to use;
- The vocabulary organization should be clear and intuitive;
- The navigation of the system should be seamless and evident to all users;
- New sentence generation should be done as dynamically and with as much flexibility as possible;
- The number of clicks that a user has to press to generate a sentence should be kept minimal;
- The communication system to be built should reflect as closely as possible the way users communicate in the real world (see the domain theory above);
- The system should provide an appropriate level of performance: the elapsed time between the click of an icon and the sound generation should be minimal, (emergency calls and messages should be fast and accurate)
• The sentence building should be done as accurately as possible (considering grammatical constraints of natural language)
• The system should be customizable to every user in the context of making sense of a visual clue as the user wants, how he/she wants to view the clues and what speech should be generated (if the user wants to generate it)
• The system should be easily extensible to accommodate the following typical variations: variations in interface, language, definitive needs of the user, new features, new hardware etc.

III. The Deliverable
Your description should be elegant and comprehensible. Your deliverable should be available as both online (one URL per team member) and offline specifications (submission of one copy per team). You can choose to use an (extended) IEEE-style format for the deliverable, in which the major sections typically include: Introduction, Main Body (items below, for this project), Glossary (Definitions and Acronyms) and References (See, for example, "Document Templates - general IEEE" on the course website).

1. Issues
Describe any issues (e.g., incompleteness, inconsistency, ambiguity, redundancy, unsoundness) that you encounter in the informal preliminary definition. Also describe how you have resolved such issues. Describe what your choice is and why you have made that particular choice (i.e., because that particular choice is good with respect to some reasons - design rationale).
For another example, system extensibility can be enhanced additionally by allowing a participant to add a partial category. This is an example of requirements incompleteness.
In order to resolve the issues, you might need to use your own "creative imagination", but based on your teamwork.

2. Improved Understanding
Prepare a clarified definition of the preliminary definition given as much as possible, while discovering and resolving any possible defects per your discussion in 1. Try to clarify both the domain description and the system description, while establishing the traceability between the two.

3. A Prototype
Build a prototype of your HOPE (a mockup will do for this phase). A (preliminary) user manual should be developed, which should become more complete and consistent at the end of the 2nd phase of the project.

N.B:
• Your team should submit an updated Project Plan too;
• The 2nd last slide/page should describe the requirements creeping rate your team can handle;
• The last slide/page should describe why your team’s product is thought to be the best
• The prototype/user manual can be described separately from your team’s WRS document, if you team so wishes.