IEEE HUMANITARIAN TECHNOLOGY CHALLENGE

HTC STUDENT DESIGN PROJECT

REGION COMPETITION GUIDELINES

HTC PROJECT DESIGN COMPETITION

BACKGROUND

The IEEE Humanitarian Technology Challenge is a partnership between the IEEE, UN Foundation and the Vodafone Foundation targeted at developing technological solutions to some of the greatest challenges facing humanitarian health and disaster workers today. The goal is to bring together humanitarian service providers, IEEE members and other technologists around the world to collaborate for the benefit of humanity.

Selected IEEE senior volunteers were asked to review humanitarian needs using information gathered in focus groups of health response organizations, non-governmental organizations (NGO) and other emergency response organizations. Those needs were reviewed in more detail from a technology perspective as IEEE asked such questions as:

- What technologies might be applicable in addressing these needs?
- What work has been done or is currently underway in those technologies?
- What is the status of the work, timeframe for completion?
- Who is doing the work?

Based on an analysis of the numerous challenges that are faced by response teams globally, IEEE and the UN Foundation developed a prioritized listing of the over 30 technology challenges. The top three challenges were identified as:

1. **Reliable Electricity**
   Increase the availability of electric power in resource-constrained environments. Inexpensive, reliable electricity generation on a small scale (home or village) can provide lighting at night, charging of cell phones, refrigeration, and other communications, education, and economic development functions.

   Specific design considerations for Reliable Energy projects included:
   - Low power stationary facilities
   - Rugged, mobile power supplies for emergency settings
   - Mechanical transducers
   - Passive generation devices (e.g., charge as you walk)
   - Renewable energy hubs

2. **Data Connectivity of Rural District Health Offices**
   Sharing information and exchanging data among remote health clinics and providers with central health facilities, hospitals and ministries is a significant challenge to tracking outbreaks of disease and ensuring the appropriate treatments and medicines get to those who need it most. Improving communication between these entities can improve access to treatment protocols, monitor health trends, and share results of treatments.

Specific design considerations for Data Connectivity projects included:

- Two way transmission – upload, download
- Data could be batched for daily transfer
- Also useful for emergency/outbreak alerts
- Less expensive service and higher bandwidth needed
- Create maps of existing connectivity
- Use intermediate field offices as data relay points

3. Individual ID and tied to Health Record Tracking

Keeping health records in the developing world is sporadic at best and tying them to treatment regimens and tracking the impact of them is sorely lacking. When individuals are displaced by natural, man-caused disasters or diaspora, it is vital for NGO's and Governments to understand the healthcare needs of refugees and be able to deliver the appropriate treatment – especially for those with chronic diseases.

Specific design considerations for Individual ID and Health Record Tracking projects included:

- Secure, confidential ID for patients
- Emergency Response and Chronic Care Applications
- Useful for routine care for migrant populations

I. IEEE-HTC STUDENT DESIGN PROJECT OBJECTIVE

The objective of the IEEE-HTC Student Design Project is to provide a working prototype, scale model or detailed engineering design specifications for a project that satisfies one of the three HTC Challenges.

University students participating in the IEEE-HTC Design Project are required to specify the following:

- The scope of the project
- The location where the project is/will be installed or tested
- Project results (impact, value, cost, anticipated changes, maintenance, manufacture & production)
- Implementation plan

II. ELIGIBILITY AND TEAM COMPOSITION

The IEEE-HTC Student Design Project can be developed by individuals or by student teams. The students are responsible for all of the R&D activities and the creation of the working model or prototype. There must be student accountability for all elements of the project. The engineering and design process is normally a team effort and as a team, each team member must be able to clearly communicate design ideas and suggestions to team members and other associates. Interdisciplinary and cross-institutional collaborations are encouraged.

For a team to be eligible for the competition, the team must be led by an IEEE student member who is in good standing at the time of final project submission. Teams may include students who are not IEEE members.

The students may choose to engage faculty members or representatives from industry to serve as mentors, champions or otherwise provide guidance as needed. Such advisors may receive acknowledgement of their roles in assisting winning teams, but will not be eligible for any monetary awards.

III. IEEE-HTC DESIGN PROJECT STATEMENT AND BACKGROUND

Each individual or student team will create a solution that directly correlates to one of the three HTC defined technology challenges.
The student teams must:

a. Define the scope of their project
b. Conduct any analysis and design relative to their project
c. Develop and present a project plan
d. Identify the technology and technical solution being proposed by their project
e. Provide applicable R&D information, manufacturing/distribution issues, costs, etc.
f. Be prepared to defend the design and discuss the immediate and strategic functional, installation or implementation considerations

IV. TIMING

The competition will begin in September 2009, and conclude in May 2010. The schedule will be as follows:

October 30, 2009	Letter of intent submitted to competition administrator, describing the project to be undertaken, the applicable HTC Challenge and the names of team members.
February 5, 2010	Progress report submitted describing the status of the project in terms of milestones accomplished and deliverables completed.
May 28, 2010	Final Reports submitted
June-July, 2010	Review of projects by panels of judges; presentations by finalists
August, 2010	Announcement of Award winners

***Note:** each Region will control the specific competition timing.*

V. DELIVERABLES

The February Progress Report will consist of a discussion or on-line presentation of the:

- Project Scope
- Project milestones
- Project plan

The IEEE-HTC Student Design Project has four final deliverables due May 28, 2010:

1. A physical model, prototype or working unit of the product or solution that has been developed.
2. Documentation that provides complete records of the design considerations and design rational including:
    a. The project team
    b. The HTC technology challenge with which the project is identified
    c. Project attributes
    d. Project status
    e. Unique intellectual property the project uses or was developed
    f. The overall application and value of the project
    g. Project costs
    h. The project implementation plan
3. A 500 – 1,000 word Project Summary describing the design features and key attributes of the project.
4. A 30 - minute verbal presentation by the team to a panel of judges.

VI. PROJECT SUBMISSION

All entries must be submitted through the IEEE – Humanitarian Technology Challenge collaboration web site: www.ieeehtc.org.

During the competition registration process, each team leader will request a Spigit (the HTC knowledge-base platform) ID. An ID and log-on password will be assigned. The competition website will have competition guidelines, a Spigit User Guide and summary instructions, FAQs, and other important competition information.

Student teams may optionally choose to post preliminary versions of their projects in Spigit in order to solicit comments and advice from the technical professionals and humanitarians participating in the HTC project.

VII. AWARDS & RECOGNITION

Each IEEE Region will be provided prize and award support from the IEEE-HTC Committee. The IEEE Region will recognize the prizewinners during an appropriate IEEE sponsored event.

The specific prizes and team recognition categories will be announced in February.

All student team members and individuals who were identified as mentors, champions or who otherwise provided support will receive appropriate non-monetary recognition.

The Competition Judges will be solely responsible for selecting the winning projects and project teams.

VIII. JUDGING PROCESS

The Region HTC coordinator will be responsible for identifying regional judges. Working with the Region Student Activities Coordinator and the Region Director, the competition will be judged using the same structure currently employed by the Student Paper Competition.

Separate panels of HTC designated judges will be established at the Region level, each responsible for reviewing a subset of submissions, depending on the total number received. The Regional Judging Panels will recommend the regional award recipients.

The decision of the judges is final.

IX. EVALUATION CRITERIA

The design submitted will be evaluated considering many different criteria. The applicability of the design, the feasibility of the final product and the portability of the solution are primary considerations.

The Humanitarian Technology Challenge project seeks to develop solutions that have the following characteristics:

- Thoroughly described technically, including functional description, technical specifications, development staging, physical manufacturing considerations, and product testing ideas;
- Clearly specified standards and interfaces, including environmental constraints, cultural adoption requirements, reliability and availability

specifications, interoperability requirements, and integration testing considerations;

- Associated Operations, Administration and Maintenance plans which address how solutions are engineered, installed, operated, administered, maintained, and how personnel are trained and motivated to perform these duties;
- Economic Implementation Plan, describing target segments and customers, "pain points" of users, value propositions, staging and scaling of solutions, distribution systems, production economics, and ideas for economic validation;
- Identified Stakeholders, including potential product developers, entrepreneurial considerations, funding foundations, Non-Governmental Organizations, Government Agencies, and others;
- Potential prototypes and field trials; and
- Identified related work already underway by others.

It is not expected that student submissions will address all of these facets, but preference will be given to those who meet many.

Project requirements are purposely extensive and defined by a specific set of deliverables including a physical model or prototype, documentation, project summary and presentation. These requirements are comparable to expectations of senior or community service projects offered by many university engineering programs.

Design **30 %**

The design team will create a design with a focus on one of the three HTC Technology Challenges

- HTC Technical Challenge area defined
- Prototype, working model or detailed engineering design complete
- Geographic location identified
- Design files or CAD simulation
- Walk-through animation **(optional)**

Project Documentation **30 %**

The project report should provide a complete record of the project design, from concept, through R&D activities to completed product, including:

- The project team members identified with roles specified
- The HTC technology challenge with which the project is identified
- Project description, attributes, significance, contribution to HTC Technology Challenge solution
- Project status
- Intellectual Property used or created
- The overall solution method, application and value of the project
- Project budget and costs

- Project implementation plan
- Impact on the environment

Project Summary **15 %**

The 500-1,000 word Project Summary describing the design features and key attributes of the project such as:

- Unique features
- Originality of design
- Project implementation plan
- Competitive technology

Presentation **25 %**

The 30-minute team presentation will be presented to a review panel incorporating representatives from the various technical organizations, emergency response entities, humanitarian organizations and world leaders. The team presentation will be followed by a 20 – minute question and answer period. The presentation must address the following:

- The design attributes of the product
- Interesting features of the product
- Any unique ideas or research incorporated in the design

X. SAMPLE QUESTIONS AND DESIGN CONSIDERATIONS

Design Function **Points**

- Does the design directly relate to one of the three HTC defined technology challenge priorities?
- Is the design compatible to current infrastructure?
- Does the design incorporate a balance between form and function?
- Does the design make use of engineering modeling techniques?
- Does the design make use of potential local materials or local expertise
- Does the design support local customs?

Project Documentation

- Does the documentation provide the rationale behind their project selection?

- Does the documentation provide a complete explanation of the product development?
- Does the documentation provide a complete explanation of any research or unique ideas or concepts used in the project?
- Does the documentation provide an explanation of any specific engineering or cultural challenges that were overcome?
- Does the documentation meet acceptable organization, content and grammatical standards?

Project Summary

- How will the project assist in providing a solution to the problem specified?
- Does the design provide easy use and accessibility?
- Does the design improve relationships or response efforts between entities?
- Is the design easily connected to local/regional infrastructure?
- Does the design increase citizen or response organization safety?
- Is the design environmentally friendly?

Team Presentation

- Did the presentation address the functional design issues
- Does the product design improve public health, response efforts or satisfy a specific need?
- What was the contribution of each of the team members and did they demonstrate their expertise during the presentation?
- Are there design restrictions that must be considered during the installation or use process?
- Is the project accessible by the physically challenged, handicapped and elderly (as applicable)?
- Is the project cost-effective

XI. STUDENT PROJECT PLANNING SUGGESTIONS

Brooks' law is a principle in software development that states "adding manpower to a late software project makes it later". It was coined by Fred Brooks in his 1975 book The Mythical Man-Month. According to Brooks himself, the law is an "outrageous oversimplification", but it captures the general rule. Brooks points to two main factors that explain why it works this way:

1. It takes some time for the people added to a project to become productive.
2. Communication overheads increase as the number of people increase. The number of different communication channels increases along with the square of the number of people; doubling the number of people results in four times as many different conversations. Everyone working on the

same task needs to keep in sync, so as more people are added they spend more time trying to find out what everyone else is doing.

Scheduling mistakes account for a large number of late projects. Actively managing the project development plan is the best way to reach the project's goals, and we will present a Gantt chart approach to assist students in managing this. But before getting into that, the most important element of a successful project are the quantity, quality and role of the people added to the project team. Most teams will probably start with a few students that know each other and share an interest in participating in this competition; some teams may even have a general idea of a solution they want to implement. The advice given by Kathleen Melymuka, writing in Computer World (How to Pick a Project Team), will probably help. We have edited her list as follows:

- Fewer Is Better - Small project teams perform better due to a lower communication overhead (Brooks' law)
- Attitude Counts – Look for people with positive attitudes
- Diversity Lowers Risk – Extend beyond your group of friends, as you probably share similar styles and points of view: counterbalance
- Familiarity Breeds Action, and clarity avoids conflict – Set clear ground rules at the very start of your project. Set clear achievable goals for your team as a whole and for individuals within your team. Goals must be unambiguous and they must be mutually attainable. (SMART)
- Availability Trumps Everything – Encourage individuals to be accountable to the team; help all make sensible commitments to the project, as everyone will be trying to fit it within an already busy academic and personal schedule.

The second most important element is selecting a challenge to tackle, you may do this based on your team affinity, or team core skills. It is important to gain the commitment of the team to find a solution to the selected challenge; otherwise, the project will suffer. Once these two steps are cleared, the real work begins. One of the initial meetings the team should have is a planning meeting with to help all team members become familiar with the HTC Student Project competition: objectives, requirements, timeline, deliverables and evaluation criteria. A key outcome of this meeting is the definition of a formal or informal development process that will be followed through out the project development; this process should clearly, for example, who will keep the project documents up-to-date, how often updates shall be reported back to the team, what means will be used to communicate (Google docs, email, etc). Another key initial meeting that the team should have is a brainstorming meeting, it may be combined with the one above. A key outcome of this meeting is the generation of as many solutions as possible, to have a creative pool to draw from as the projects forms. There are four basic rules in brainstorming. These are intended to reduce social inhibitions among group members, stimulate idea generation, and increase overall creativity of the group:

1. Focus on quantity: the greater the number of ideas generated, the greater the chance of producing a radical and effective solution.
2. Withhold criticism: focus on extending or adding to ideas, reserving criticism for a later 'critical stage' of the process.
3. Welcome unusual ideas: unusual ideas are welcomed, and can be generated by looking from new perspectives and suspending assumptions.
4. Combine and improve ideas: Good ideas may be combined to form a single better good idea, as suggested by the slogan "1+1=3".

A brainstorming session could be structured as follows:

1. Create a background memo - provide context information to participants, describing the problem in the form of a question, with some example ideas.
2. Create a list of lead questions - the facilitator may stimulate creativity by suggesting a lead question to answer. It is best to prepare a list of such leads before the session begins.
3. The facilitator leads the brainstorming session and ensures that ground rules are followed. The steps in a typical session are:
    1. A warm-up session, to expose novice participants to the criticism-free environment. A simple problem is brainstormed, for example “What should be the CEO retirement present?” or “What can be improved in Microsoft Windows?”
    2. The facilitator presents the problem and gives a further explanation if needed.
    3. The facilitator asks the brainstorming group for their ideas.
    4. If no ideas are forthcoming, the facilitator suggests a lead to encourage creativity.
    5. All participants present their ideas, and the idea collector records them.
    6. To ensure clarity, participants may elaborate on their ideas.
    7. When time is up, the facilitator organizes the ideas based on the topic goal and encourages discussion.
    8. Ideas are categorized.
    9. The whole list is reviewed to ensure that everyone understands the ideas.
    10. Duplicate ideas and obviously infeasible solutions are removed.

Brainstorming is not just about generating ideas for others to evaluate and select. Usually the group itself will, in its final stage, evaluate the ideas and select one as the solution to the problem proposed to the group.

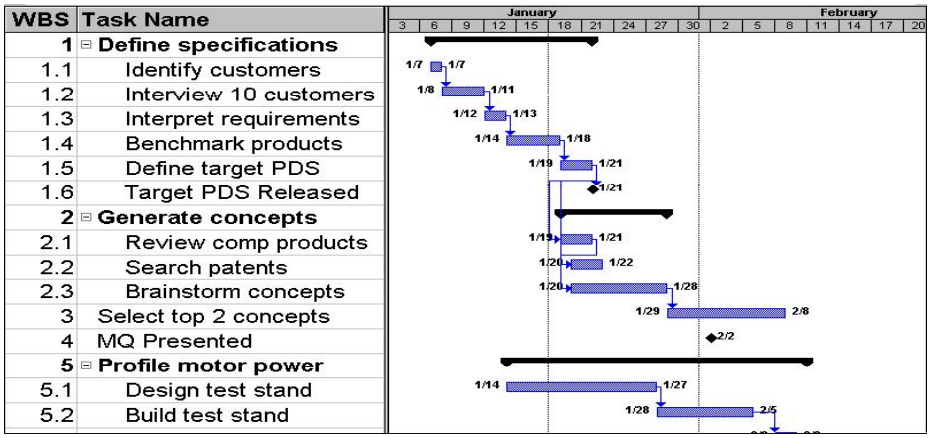
Finally, once a solution is selected, it is key to divide it into tasks and to assign these to team members within the framework of a schedule. We will describe the Gantt chart technique to manage a project: the technique used is not important, but adopting a proved project management technique will significantly increase the chances of success. In all cases, the “task” is the basic unit of interest. In this

context, a task is some significant activity the group will need to perform to accomplish its goals. Tasks are given:

- a name/description (typically, verb-noun, as in "design control board" or "research literature")
- an estimate of the amount of calendar time required
- a list of other tasks (if any) that must be completed before this task can begin (or end)—i.e., dependencies.

Other task attributes can be added if desired, such as time required in person-hours and other resources required (e.g., financial, special skills, special equipment).

Henry L. Gantt, an American engineer and social scientist, invented the Gantt chart in the early 1900's. The horizontal axis is (linear) time; each task is given its own horizontal band where the calendar duration of the task is indicated by a box, line, or other object with a variable horizontal dimension. Tasks are often grouped into categories, and each category can be treated as a summary task whose duration spans all the tasks within that category. Tasks are generally listed from top to bottom in the order they will occur; if there are groups of tasks, the tasks are chronological (by starting date) within a group, and the groups ordered by starting date. A vertical line is usually placed on the chart to show the current date. Other important milestones can be noted (and labeled) with dotted vertical



lines at the appropriate dates.

What follows is one way of creating a Gantt chart.

1. List all known milestones, deadlines, and deliverables (papers, presentations, etc.)
2. List all outside constraints on time (holidays, exams, etc.), money, equipment, etc.
3. Create a list of tasks (Note - the procurement of parts, equipment, and even expertise/knowledge might be a task in itself.):
   a) brainstorm a list of as many possible tasks for the project as possible.
   b) group brainstormed tasks (e.g., documentation, prototype, etc.).
   c) review task groups and brainstorm additions within the category
   d) go back and eliminate any tasks that are not significant or relevant.

4. For each task in the list
    a) time (in person-hours, then estimate calendar)
    b) dependencies (other tasks)
    c) resources (money, parts, equipment)
    d) who will be doing it (subject to required knowledge/skill, or availability)
5. Organize the task groups by starting date (or other logical and consistent criteria), and tasks within groups by starting date
6. Use Excel or other tool to create the Gantt chart

Finally, we are providing the following Project Cover Sheet as a template that teams shall use when submitting their proposals. It includes a simple Gantt chart with tasks relating to the evaluation criteria of this competition. We hope our simple project planning suggestions will allow you creativity and talent come through in helping us find solutions to our three challenges.

Welcome aboard.

Project Cover Sheet	Date: Academic/Industry Mentor Name: E-mail: Tel.:	Required at completion: 1. Scope of the project 2. Location where installed or tested 3. Results: impact, cost,, value, maintenance, manufacture/production 4. Implementation plan
Drawing/Specification title and number		

Team Member	e-mail	Role/Responsibility

Team Name and mission statement

System Description: What problem it solves (Reliable Electricity, Data Connectivity, Individual ID and Health Records)

5. Project Summary (200 words): What specifically is your device/system will solve? How does will you measure success?