ELIXIR

Introduction

"Every day 1,000 Indian children die because of diarrhea alone"

As we move ahead in the twenty first century, India demands not only advanced healthcare solutions suited to rapidly changing lifestyles but at the same time basic healthcare solutions to cater to the current woes of our masses.

Elixir is an effort inviting solutions and innovations that stand a chance to conquer the challenges we face today. It holds a unique position as it deals intimately with human health and wellness. Elixir gives a platform to strive for excellence in healthcare technology by fostering inter-disciplinary research through quality mentorship and guidance for further development.

In nothing do men more nearly approach the gods than in giving health to men.

Problem Statement

This year, we are proposing an open biomedical design competition, in order to stimulate creative and innovative students to come up with solutions to current problems that impact the quality of health care in urban and rural areas. We have provided some sample problems below. However, a participant can submit any other idea that will have an impact on the current state of healthcare in India.

Low cost, Portable, Subcutaneous Infusion Pump

A subcutaneous infusion is an infusion of fluid under the skin. Also known as hypodermoclysis or interstitial infusion, this technique can be used in the treatment and management of many health conditions, especially when care is being provided at home. In a subcutaneous infusion, a needle is inserted under the skin, rather than into a vein (blood vessel), and connected to an infusion pump which allows fluid to slowly enter the injection site. This may be as simple as hanging a bag of fluids and allowing gravity to do the work, or a mechanized pump may be used to precisely control the dosage and to allow the patient to adjust it, if necessary. This includes pumps which can be attached to the body of patients who need long term subcutaneous infusions. Some patients cannot take medications orally or rectally and have poor venous access, making subcutaneous infusion the best method for drug delivery. This method is also inexpensive to administer and it can be performed by people without formal medical training.

To develop a low cost, portable, infusion pump, suitable and affordable at personal level by middle income group among Indian patients.

Breath Monitor

In newly born babies the temperature of breath and respiratory rate plays an important role in determination of diseases in newborns. The average rate of breathing in newborns is 44 breaths per minute. There are various diseases that can be due to alteration in respiratory rate. Abnormal breathing rates in babies are often an indication of some problem. Breathing rate thus becomes an important tool for early diagnosis of diseases.

The challenge is to design an instrument that can measure respiration rate (time interval between two breaths) and temperature of air exhaled out.

Suturing of Skin

Suturing of skin is the stitching together of skin tissues. Sutures are a necessary component to the healing process after any serious injury or a surgery. Many a times, due to lack of time and manpower, suturing is not done properly. Improper suturing leads to adverse effects, including infections, a re-opening of the wound, blood loss, and heavy scarring.

The challenge is to design an automatic machine which can do suturing of skin (for superficial cut). The machine should be able to do cleaning of cut area, do good approximation so that edges of skin tissues come in contact while suturing. The material used to stitch can be a sponge with cover of thin leather or cycle tyre tube and stitching can be done with the use of surgical suture thread.

Blood Pressure Measuring Apparatus Failure Detection

Measurement of blood pressure is a very important part of diagnosis. There are three types of blood pressure measuring apparatus available in the market-Mercury Column Based, Dial type and electronic. The expectation however is that they would be used once or twice per day at home. These devices last many years when used according to expectations. However, in government hospitals, they are used 24 hours a day. Due to excessive usage the product usually fails earlier than expected.

The task at hand is to device an instrument which should be able to check whether a blood pressure apparatus has failed or not. The device should be able to detect whether an apparatus is giving proper readings and should also be able to re-calibrate the apparatus.

Playful Feedback Mechanism for Muscle Tone Control

Cerebral Palsy is a condition in which people face problems co-ordinating muscle movement since they lose muscle tone control. Normally, our muscle motion is highly coordinated and precise whereas in a person with cerebral palsy condition, muscle motion is highly un-coordinated and jerky. By introduction of feedback system it might be possible to help the children in controlling their muscle movement. Feedback systems involve doing

actions and getting a reaction (response) for that particular action. The feedback can be either audio, visual or combination of both, and can be designed in the form of a small game for keeping the child occupied for at least half an hour. The feedback can also be in the form of competition between two children. The system would also be useful for normal children to develop their motor skills from early childhood.

Develop a portable system (game/toy) which can be used either by toe tips or by fingers to get a feedback from the actions of muscles in hand or legs. The feedback can be a qualitative or quantitative way to help the child control his muscle movement. The idea is to have a system (game/toy) which can generate different responses for different muscle movements.

Prosthetic Limbs

The human body is a remarkable piece of biological machinery, but having physical incapacity as a result of the loss of a limb is tragic. With the advancement of science and technology, artificial replacement through prosthetic limbs has improved lives of many disabled people. The scope for discovery and innovation in the field of prosthetics is limitless. Till now, prosthetic limbs available are very costly and not technologically advanced. They lack the capability of integrating with the human body and work as a real limb.

The challenge here is to make prosthetic limbs which can be integrated with body part and can effect movement by sensing facial expression, muscle movement, eye motion etc. (for ex. If you are making a prosthetic hand then the muscles of the upper part of the hand can be used as stimulus for movement of the prosthetic limb).

Innovate and Create

The fields suggested above are just few examples to initiate the thought process and should only be taken as a starting point in the innovation process. The participants are free to choose any field in which they feel the need to innovate and come up with solutions. Also provided below is a pool of ideas encompassing various aspects of the healthcare systems today.

The list given below is not exhaustive and should be used as reference –

1. Mechanisms to detect, rehabilitate or prevent falls while walking in patients suffering from Parkinson's condition.
2. Non-invasive blood monitoring systems for measuring glucose concentration, urea, hemoglobin level.
3. Light weight, portable baby incubator affordable by primary health centers in rural areas and which can work while transferring baby in 3 hours from a primary healthcare centre in village to nearby hospitals. The device should be following all specifications required for premature babies like temperature, oxygen supply, humidity and sterility etc.
4. Devise a small automated thermometer with storage capacity, which can store data of fluctuation in temperature over a period of time. The device should not interfere with the patient's sleep or work.

5. Devices and systems for advancement of healthcare in rural areas.
6. Mechanisms/devices for safe disposal of medical waste in an environment friendly way.
7. Pulse analyzing device to measure pulse rate, blood flow in pulse and analyze the type of pulse (thread, smooth, wiry or normal).
8. Portable, low-cost microscope with image processing system and send the image to nearest hospital through data transmission.
9. Low-cost diagnostic kits for diseases like Malaria, MDR tuberculosis, AIDS etc. and presence of pathogens in air or water.
10. Walking aids or computer aided navigation devices for the blind which help them in easy movement by detecting obstacles in their path and communicating their position and that of the surroundings.
11. Wireless devices like ECG.
12. Stethoscopes which can analyze sound pattern store it and transfer that information to mobiles etc.

Note: If you can come up with any other such problems, solutions for them are also invited.

Competition Structure

Abstract Stage	August 27th, 2010	To be considered for mentorship stage, participants have to register and submit their abstract before August 27th in the format specified below.
Mentorship stage	September 15th, 2010 to November 20th, 2010	Mentors will be allotted to shortlisted participants on September 15th. Participants have to submit the progress report of their project every 15 days. A final report with video of working model should be submitted before November 20th.
Deadline for open entries	November 15th, 2010	Last date for registration of open entries as well as international participants. However, the final report and video of working model can be submitted till November 20th.
Result	December 5th, 2010	Declaration of shortlisted candidates for presentation during Techfest 2011.
Improvisation Stage	December 5th, 2010 to January 6th, 2010	Shortlisted participants to improve upon the working prototype of their project and prepare a presentation for the same.
Presentation Stage	January 7th-9th, 2011	Final presentation along with the demonstration of the working prototype.

Note: Participants unable to submit their abstracts by 27th August 2010 or those who haven't been shortlisted for mentor allocation can still participate by sending us a detailed technical report by 20th November 2010 (The last date for registration).

Abstract Content

It is recommended that the abstract be as concise as possible, however the following points must be addressed in the abstract (a slide on each of the mentioned sub-topics would do):

1) **Introduction**
   a. Background of the problem to be solved and what has been done in the past to address the issue.
   b. Description of concept, idea or approach to solve the problem.

2) **Technical details of product or method**
   a. Rough technical specifications, pictorial representation of the product.
   b. Performance evaluation of the product.
   c. Pictorial representation of the product.
   d. Pros and cons of the product with respect to existing technology.

3) **Plans of implementation**
   a. Approximate cost of the product or method developed.
   b. Potential beneficiaries or customers.
   c. Plans for mass manufacture (if any).
   d. Any other relevant information in this regard.

The names of the shortlisted participants will be available on the website by 15th September 2010.

Abstract Submission

All submitted abstracts will be screened and the teams will be shortlisted based on these. Among these a few top student teams would be provided with mentors. A mentor would be an expert in the field relevant to the subject of the abstract. He would be of immense help in carving your brainchild into an implementable solution by providing you with guidance at each step.

The last date for submitting the abstract is 27th August 2010.

If a team is not allotted with a mentor, it does not mean they are disqualified. They can take part in the model making stage and submit the model documentation before the last date.

The abstracts should be mailed to elixir[at]techfest[dot]org with the subject "Prayaas: Elixir Abstract Reg. No. (xxxx)" For ex. Prayaas: Elixir Abstract 1424. **Please do not forget to mention your registration number** in your abstract while sending it.

Model Documentation - Technical Report and Video

After the short listing, participants will have to make a physical model for the solution, which will be reviewed in this stage. The participants will be required to submit a technical report and a video to demonstrate the progress made on their working model. **The last date for the submission of the technical report and the video is 20th November 2010.** The panel of judges will analyze the report and the video and will give them a detailed feedback as to how the model can be modified to achieve a better result. The details of the shortlisted participants along with feedback from the judges would be communicated to them by 30th November 2010.

The report and the video should be mailed by post to the following address:
Techfest Office
Students' Gymkhana,
IIT Bombay, Powai,
Mumbai- 400076.

Working Prototype and Final Presentation

After declaration of the finalists, participants will be required to make a working prototype* of the project as well as a presentation covering the technical and financial aspects in a detailed manner. The teams will have to bring their prototypes to be judged and showcased at Techfest 2011.

No new entries will be entertained after 20th November 2010.

Judging Criteria

Elixir will be judged by a panel of experts in the field of application. The following are the criteria for judging the solutions:

1. Innovation involved in the development of the idea and its practicality.
2. Implementability of the product.
3. Cost efficiency.
4. User friendliness of the product.
5. Conditions and the feasibility criteria under which your solution can be implemented.
6. Superiority of the product over existing products in market.
7. Potential impact on the masses (quantity as well as quality).

*In some cases where it is not possible to make a working model then the team should make a physical model of their design and/or a CAD-CAM design.

General Rules

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1. The competition is open to all (students, research scholars and professionals). All projects being displayed will have a fair chance of receiving further development opportunities offered by funding organizations and companies. However, the prize money can be claimed only by teams consisting of either undergraduate students and/or research scholars.
2. Every team has to register online at our website for the competition. A registration number will be allocated to the team on registration which shall be used for future reference.
3. A team can participate at any point of time before 20th November. However, the abstracts submitted before 27th August 2010 would be considered for mentorship. Teams which submit their abstracts at a later stage would be provided with mentors only if their idea is exceptionally good.
4. The decision of judges shall be treated as final and binding on all.
5. Note that at any point of time the latest information will be that which is on the site. The information provided in the pdf downloaded earlier may not be the latest. However, registered participants will be informed through mail about any changes on the site.

For International Participants

For International Participants: All International Participants will have to register before November 15th 2010, and will have to submit the videos of their models along with an abstract before November 15th 2010. The shortlisted international team details will be put up on the website by 20th November 2010.

Certificate Policy

Those participants whose ideas and plan of action are recommended by the judges on the basis of their ability to get implemented will be provided with certificates of participation. The top entries from this event will be provided with certificates of excellence.

Team Specification

The participating entries must be in a team of a maximum of 6[six] people. If the participating team feels that their idea requires more participants in their team, they can forward their request, with suitable reasons, to elixir[at]techfest[dot]org with the subject "Elixir team number increase".