2015 BMES DESIGN COMPETITION

Hosted by the UT Biomedical Engineering Society

DESIGN CHALLENGE

To design a robotic device capable of removing a tumor (plastic toy) from tissue (gelatin-like clear plastic) with as little tissue disturbance as possible.

PROPOSAL

Each team must submit a design proposal due by Thursday, February 26, 2015 at 6pm. Proposals will be evaluated and selected teams will be notified February 27, 2015.

Part 1: Purpose of Proposal

Design proposals will be used to select qualified and motivated teams to participate in the Spring 2015 Design Competition. While we would like all students to have the chance to participate, however due to limitations in the number of LEGO Mindstorm kits, funding, and space, the number of teams in the competition must be restricted. The proposal is an opportunity for student to exhibit their motivation for competing, as well as their ideas on how to overcome the challenging nature of this year's design competition.

Further, each group will give a ten-minute presentation on the day of competition, describing the background, motivation, defense and demo of their robotic suturing device design. The proposal is meant to initiate and accelerate the brainstorming process as well as aid students when it comes time to put together final competition presentations.

Part 2: Format of Proposal

Each formal proposal should be between 1-2 pages and should include the following sections:

1. **Introduction**: detailing the Reason of Interest and how the design will aid surgeons during operations
2. **Materials**: should include main additional items used (e.g. wooden platforms, rubber bands, electrical tape for support, etc). See rules section below for budget limitations and use of personal items.
3. **Methods**: basic outline of design idea(s) and proposed implementation.

Providing detailed design descriptions is encouraged, however this is a creative exercise. We do not expect a final product. While the proposal will require time,

it is also an important preparatory step for each team as it is meant to aid in development and feasibility of solution ideas as well as provide preparation for final group presentations for the day of competition.

Part 3: Judging

Proposals will be graded based on feasibility, presentation, creativity and individuality of ideas. Each proposal must address how to best automate the task at hand. Clearly state the purpose of design components/layout so that application readers will understand the motivation behind the design.

Part 4: Submission

Proposals are due by **6 pm on February 26, 2015** via email to designcomp.texasbmes@gmail.com by one group member, with subject line: "2015 Design Competition Proposal: Team Name". A confirmation e-mail will be sent upon receipt of proposal to ensure that the proposal has been received.

LEGO Mindstorm Kits

Rules:

Each team must submit a **$50 deposit** before receiving a robotics kit. The deposit check will not be cashed unless the robotic kit is damaged and/or parts are lost. Additionally, if all members of a team drop out of the competition prematurely (i.e. before the competition day), deposits will not be returned. Since deposits are made on an individual basis, if individual team-members drop out of the competition, the rest of the team will still be fully refunded if they present a robot at competition and parts of the kit are not lost and/or damaged. **All members of each team will also be required to sign a form consenting to pay for all damaged and/or lost parts of the kit that are not covered by deposit fees.**

Teams are allowed to spend up to $50 on their modifications to the given kit, and up to $30 will be reimbursed by BMES. Be wary of the spending limit if your team decides to use items which you already possess. On the day of the competition, teams must provide a list of all additional items used and estimate the price of personal items used. Original receipts must also be provided to receive the reimbursement. Reimbursement and prize money will be given out upon return of a complete kit. **Keep in mind that we cannot reimburse edible items.**

Components:

Each kit includes:

- three NXT motors with encoders
- two touch sensors that react to touch and release
- a color sensor that detects different colors and light intensity
- an ultrasonic sensor that measures distance and movements, and detects objects
- in addition to these main components, a list and description of the many kit robot-building components can be found at http://shop.lego.com/en-US/LEGO-MINDSTORMS-NXT-2-0-8547 and a picture can be found below:

TASK

Your team must autonomously remove an unknown object from a 2 inch cube gel which represents a human body. The item will be approximately 1 inch in size or smaller possibly being a jack, marble or a doll. The item must be completely removed in order to count as a successful removal. The location of the item will be present at the day of the competition. Any excess materials taken off will be counted against your score. The gel must be on the table and may be secured on to the table but may not assist in the

removal of the object. The machine may surround the gel on all sides except for the bottom side of the gel which must be in the table. The machine's starting position cannot be influenced by the location of the item.

The machine must complete the whole procedure alone during the presentation without any human aid. Your team will have unlimited tries as the time allows, but only one gel. Manual resetting of the machine is allowed. The time used to accomplish the task starts with the first attempt and will continue until task is finished until time has run out. The amount of time allocated for the presentation, demo and questions is up to each individual team's discretion.

COMPETITION DAY

Presentation and Task -- 10 minutes per team
Judges -- Professors and industry leaders will evaluate presentations and performance based on the following guidelines.

- Successful completion of the task (most important)
    - Effectiveness of Automation
    - Speed
    - Accuracy
- Design Process
    - Constructive Iterations
    - Solutions to Design Complications
    - Creativity of Design
- Presentation (least important)
    - Design Defense
    - Preparedness and Speaking
    - Professionality

IMPORTANT DATES AND DEADLINES

February 19: Kick-off
February 26: Proposals due by 6pm, emailed to designcomp.texasbmes@gmail.com by one group member, with subject line: "2015 Design Competition Proposal: Team Name"
February 27: Selected teams notified, teams may pick up kits from 12 - 5pm in the BME Lobby. If you are unable to pick up a kit between this time frame, please contact us via email to schedule a different meeting time.

- Make sure to sign a disclaimer form (which will be emailed out to selected teams).
- Submit a $20 deposit **PER PERSON** (check or cash) in an envelope labeled:
    - “BMES Design Competition Spring 2015” and
    - “Your Team Name”
    - Put disclaimer forms in envelope

March 27: Competition will take place on Friday evening, with presentations starting promptly at 5:30pm, and competition ending at approximately 8:00pm.
March 30: Return Lego Mindstorms kit and submit receipts for reimbursements on any purchases of up to **$30.**

Contact Info

Design Competition Chairs**:**

Alex Dumitru and Edmund Fung
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