

eHealth Asia 2015

Virtual Reality Laparoscopy Surgical Simulator

Team Behind the VRLSS

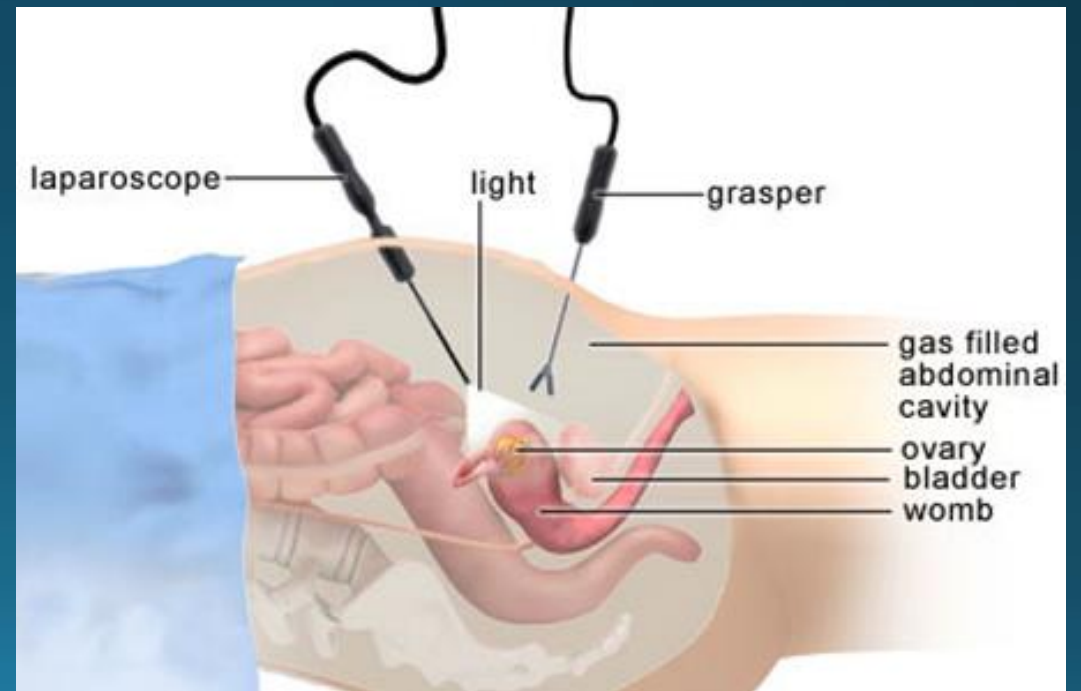
- Dr Koliya Pulasingha (Supervisor)
- Nethmini Weerawarna (Co-Supervisor)
- Pasindu Kuruppuarachchi
- Lahiru Malavige
- Priyankar Prasad
- Hansini Withanage



Sri Lanka Institute of Information Technology
Final Year Research Project

What is Laparoscopy?

A Surgery done with the assistance of a video camera and several thin instruments inserted into abdominal Cavity through small incisions made on the skin.



Why Laparoscopy?

- Less post operative pain
- Shorter hospital stay
- Faster recovery
- Fewer wound complications

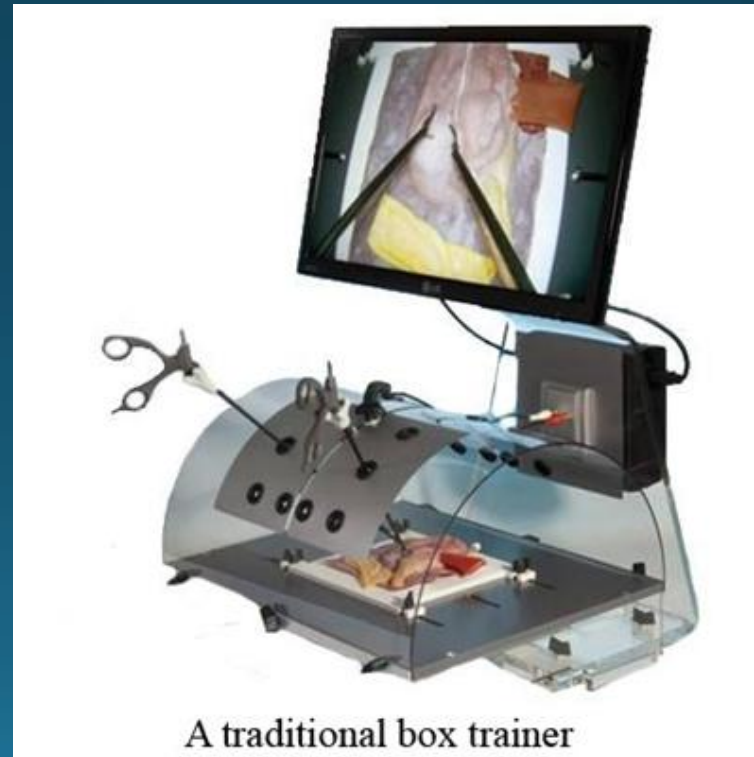
More than 7.5 Million Operations around the world using Laparoscopy [1]

Why Special Training?

- Need to use both hands
- Prevent Errors
- Working at 3D space looking from 2D view
- Instrument texture need special feeling
- Hand eye coordination
- Tactile Sensation
- To improve skills

Current Training Methods

- Animal or human cadaver models
- Live animal operations (some countries)
- Live operations
- Box trainer
- Virtual reality simulator



Animal or Human Cadaver Models

Animal Cadaver Models

Advantages

- Cheap
- Good Availability
- Good tissue handling when tissue is fresh

Disadvantages

- Anatomical difference
- Ethical concerns
- Potential risk of infections

Animal or Human Cadaver Models

Human Cadaver Models

Advantages

- High fidelity
- Same anatomy
- No issue of consent
- No time pressure

Disadvantages

- Costly
- Limited availability
- Bloodless tissue makes operating difficult
- Inability to standardize assessments due to individual variations

Live Operations

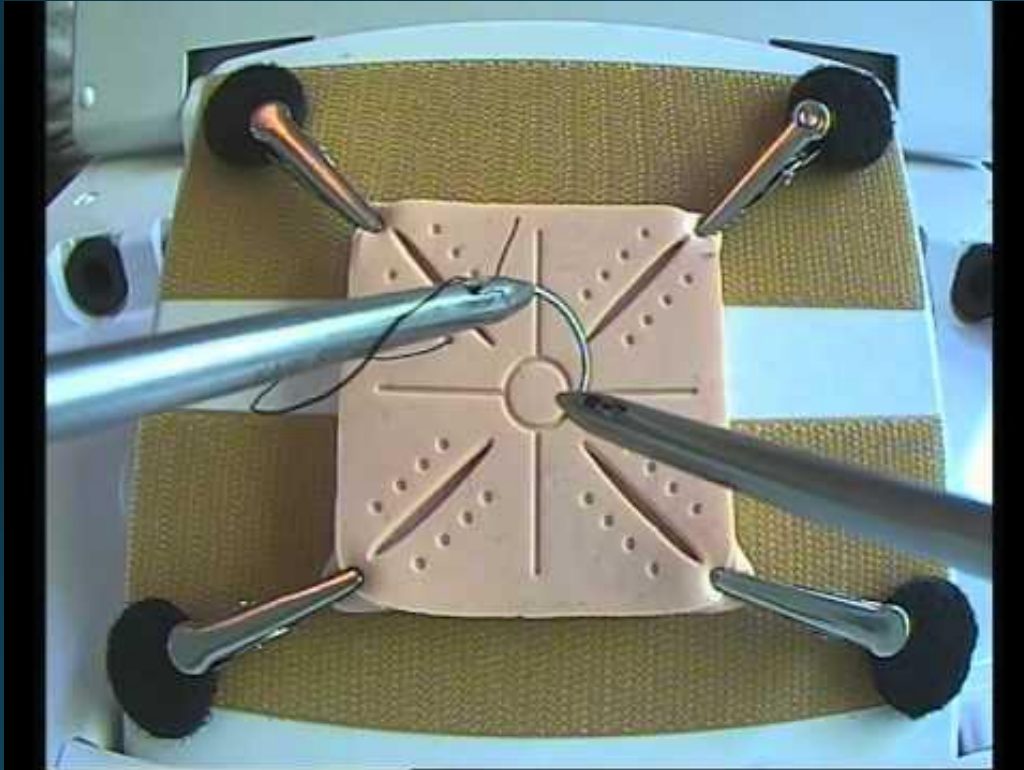
Advantages

- Exact anatomy
- Real operating theater environment
- More realistic feeling

Disadvantages

- Pressure of training vs. provision of a service
- Inability to standardize assessment due to individual variations

Box Trainer



Box Trainer cont.

Advantages

- Reproducible and standardized
- Can be train isolated skills
- Haptic feedback

Disadvantages

- Few tasks
- Outdated technology
- No anatomical structure

Virtual Reality Simulator

- More task
- Easy upgrade
- Mobility
- New trend
- Haptic Feedback
- Real Instruments
- Anatomical Models
- Operation Simulations



Problems with current Simulators

- High Cost
- Immobility
- Lack of plug and play feature
- Localize data storage



High Cost Problem



\$50,000 = Rs 6.5 Million

Lapmentor System



\$110,000 = Rs 14.3 Million
Operation Modules

\$15,000 = Rs 1.9 Million

Our Solution

- Low Cost
- Portable
- Plug and Play with Laptop or PC
- Evaluation Grading
- Easy upgrades
- Web based data storage

VRLSS

Advanced Surgery



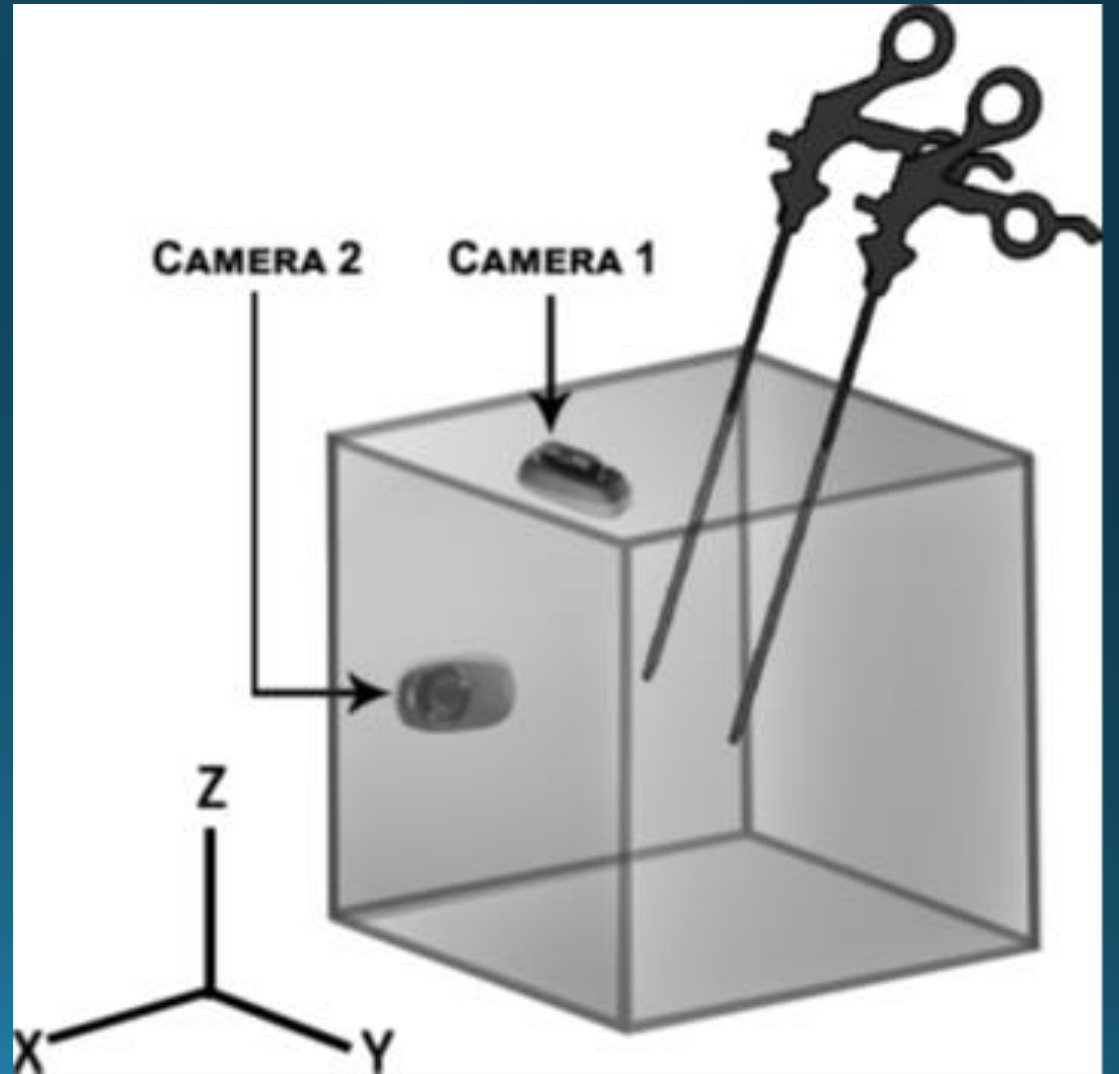
Technology Behind the VRLSS

- OpenCV object tracking algorithm
- Arduino based micro controller
- 3D max
- Unity3D game engine
- C# application for parallelism



Technology cont.

Instrument Positioning



Technology cont.

OpenCV object tracking algorithm

The screenshot displays a Windows desktop environment with three windows open. On the left is a terminal window showing a list of coordinate pairs (X1, Y1, Z1) and (X2, Y2, Z2). In the center and right are two video windows, 'LiveY' and 'LiveB', which show a sequence of frames from a video. In each frame, a red marker is visible, and its position is tracked by a red bounding box and a green line with a blue crosshair. The 'LiveY' window shows the marker in a larger, more central position, while the 'LiveB' window shows it in a smaller, more peripheral position. The terminal window contains the following data:

```
X2: 216 Y2: 462 Z2: 336  
X1: 676 Y1: 240 Z1: 4  
X1: 676 Y1: 240 Z1: 4  
X2: 216 Y2: 462 Z2: 336  
X2: 216 Y2: 462 Z2: 336  
X1: 676 Y1: 240 Z1: 4  
X1: 676 Y1: 240 Z1: 4  
X2: 216 Y2: 462 Z2: 336  
X2: 216 Y2: 462 Z2: 336  
X1: 676 Y1: 240 Z1: 0  
X1: 676 Y1: 240 Z1: 0  
X2: 216 Y2: 459 Z2: 336  
X2: 216 Y2: 459 Z2: 336  
X1: 676 Y1: 240 Z1: 0  
X1: 676 Y1: 237 Z1: 0  
X2: 216 Y2: 459 Z2: 336  
X2: 216 Y2: 459 Z2: 336  
X1: 676 Y1: 237 Z1: 4  
X1: 676 Y1: 240 Z1: 4  
X2: 216 Y2: 462 Z2: 336  
X2: 216 Y2: 462 Z2: 336  
X1: 676 Y1: 240 Z1: 4  
X1: 676 Y1: 240 Z1: 4  
X2: 220 Y2: 462 Z2: 336
```

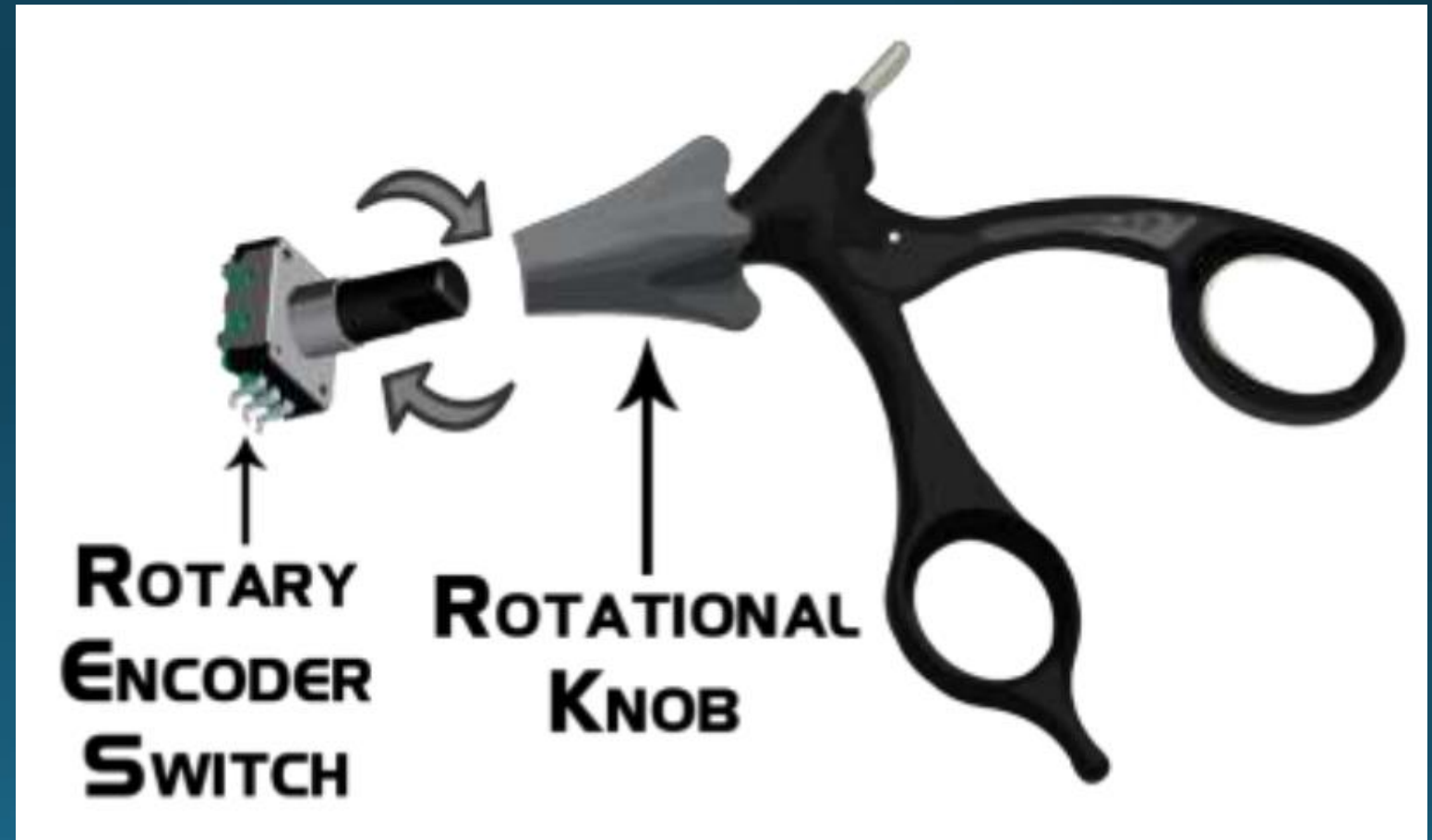
Technology cont.

Forceps open and closing simulation



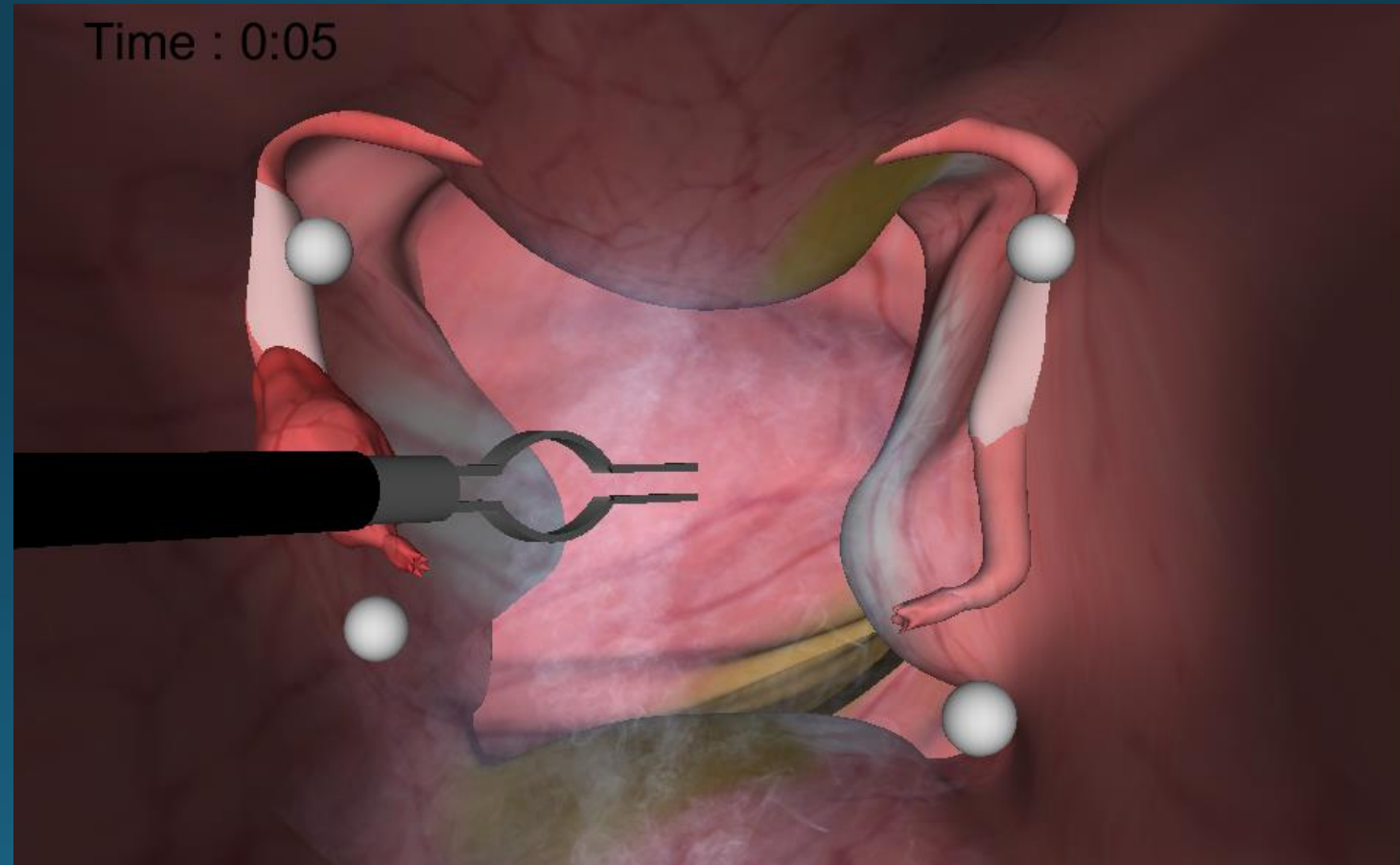
Technology cont.

Rotational Knob Simulation



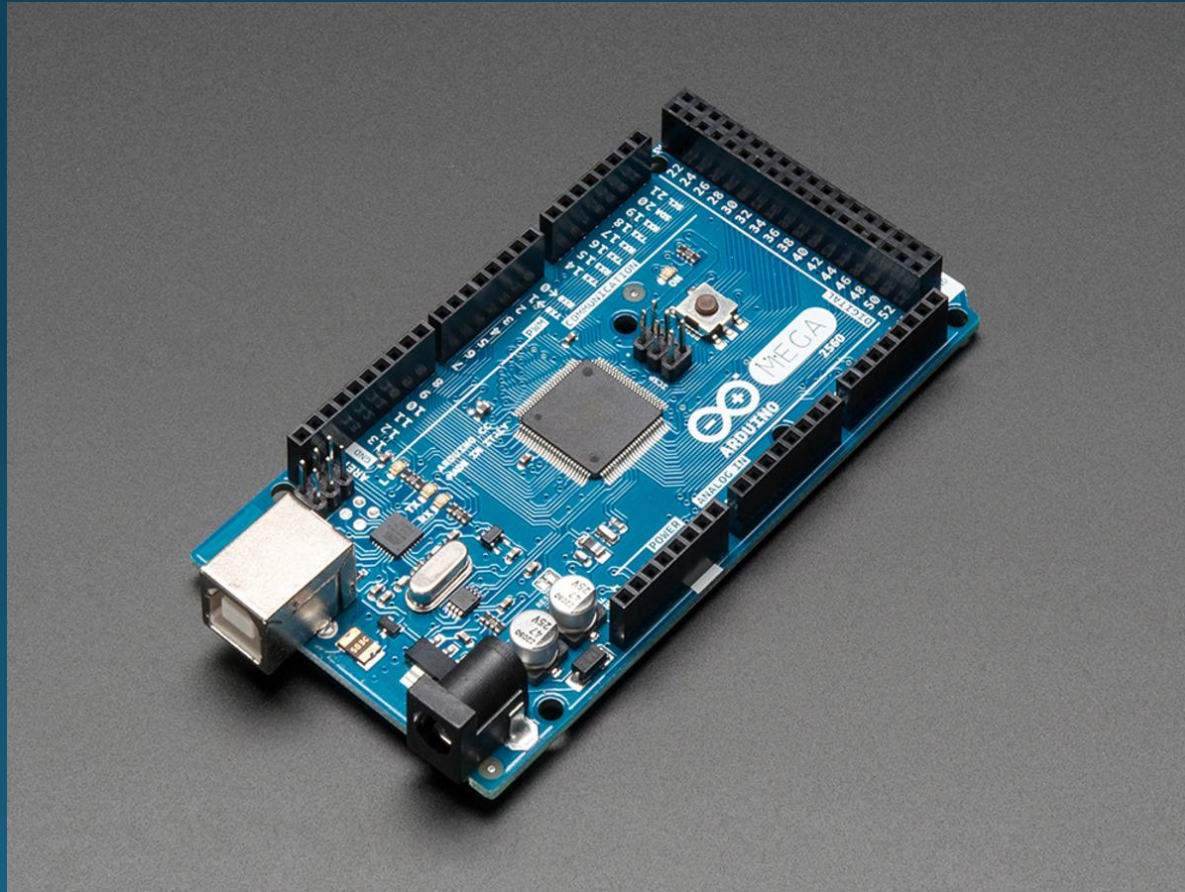
Technology cont.

Diathermy Unit Simulation



Technology cont.

Arduino Micro Controller to get sensor data



Demo

Demo YouTube Link https://youtu.be/I_JBdAbCSSE

Future of the Project

- Operation Simulations
- Assessment System
- Real Operations simulation to understand the complex problems
- Dynamic Simulations

Great Support

- All the surgeons and doctors who helped us.....
- B Braun Lanka Pvt Ltd.....



Thank You...



Contact Us : pasindumanisha@yahoo.com