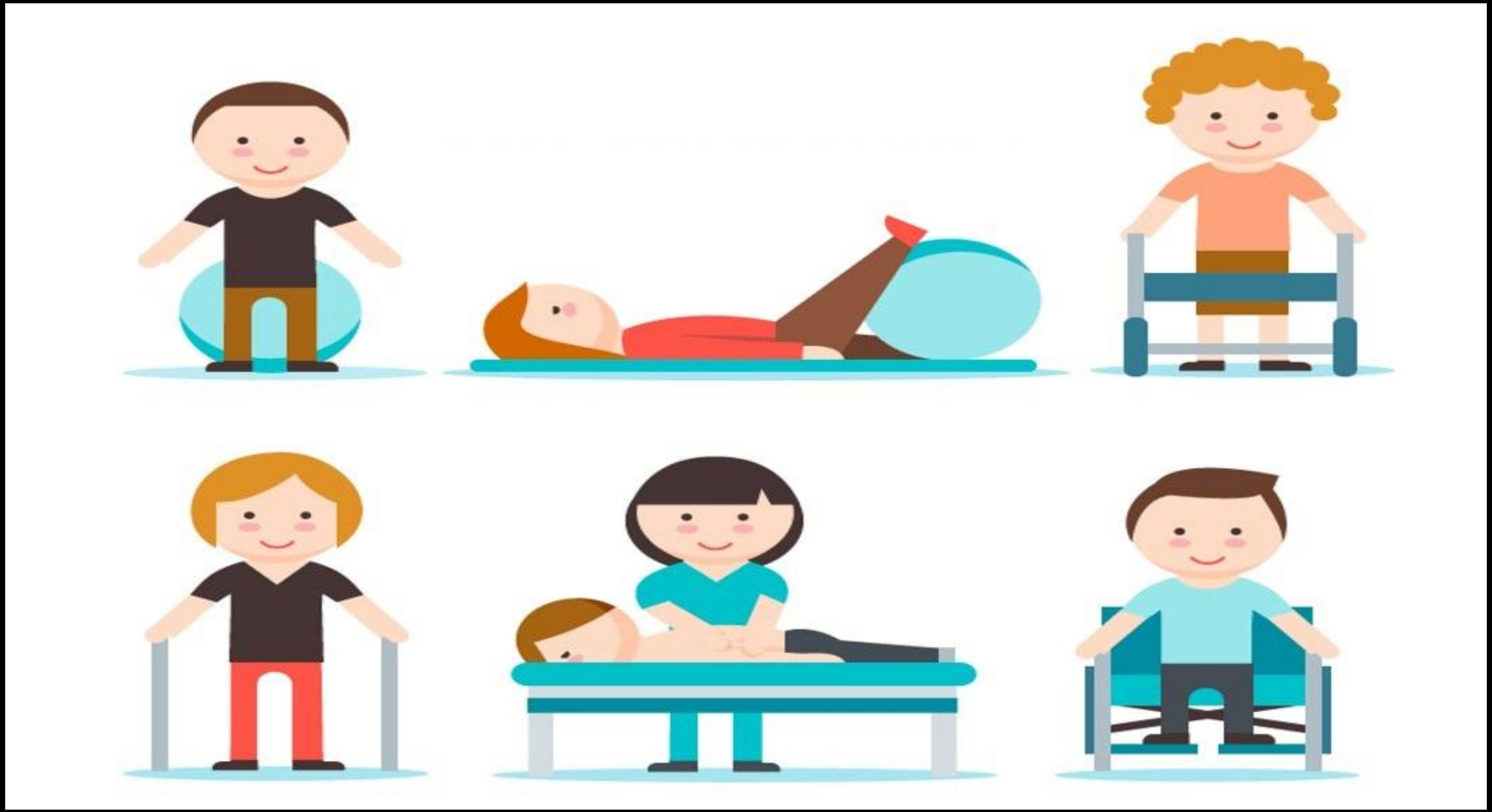
Motion Mirror

Interactive Physiotherapy



Physiotherapy is always a big part of rehabilitation, but as time goes by, patients tend to get tired and demotivated due to repetitive exercise programs.

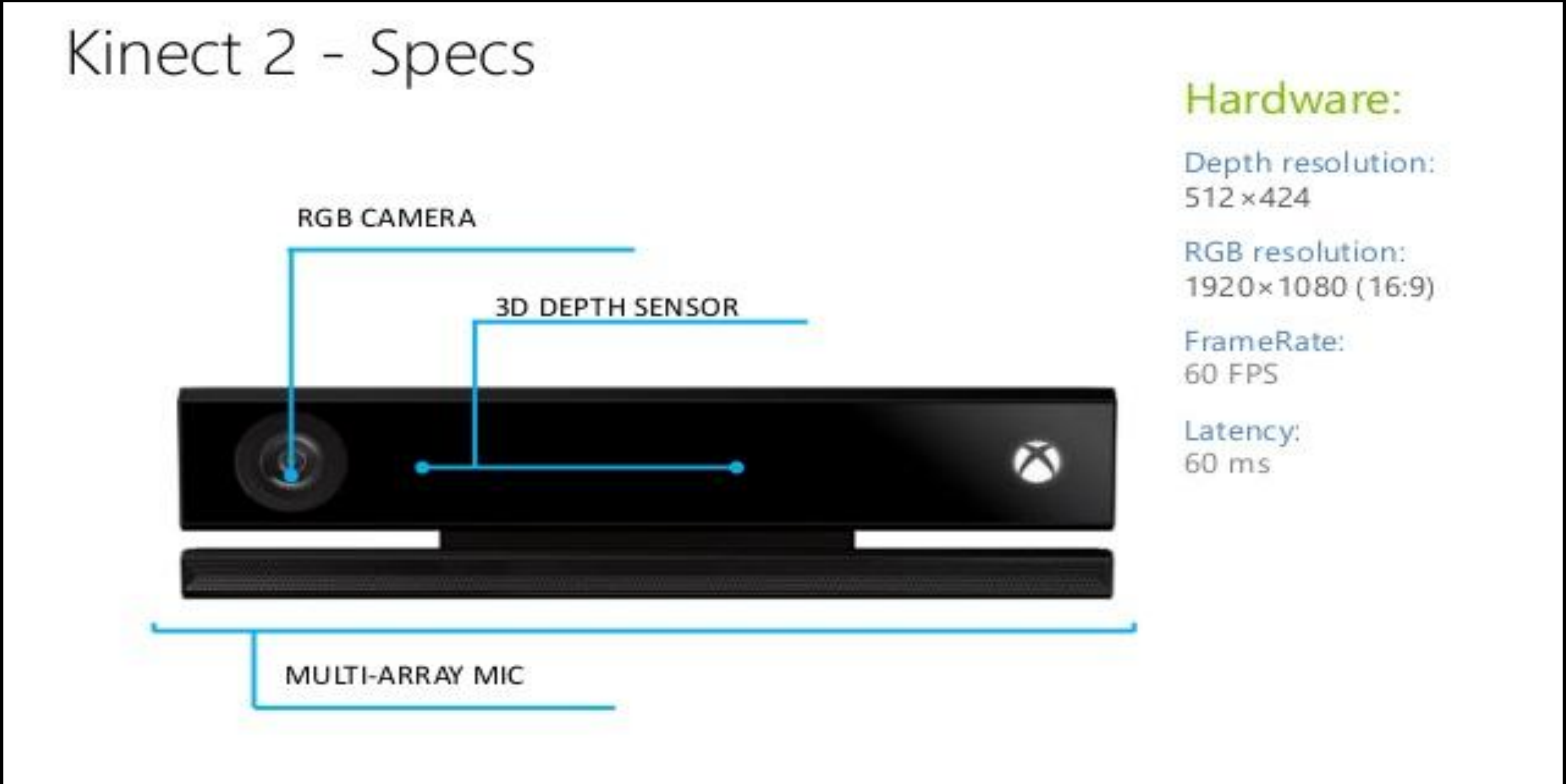
OBJECTIVE

- The aim of our project is to develop a system based on Kinect gaming that could transform tedious exercise programs in physiotherapy into an engaging enjoyable experience that patient actually looks forward to do.
- Rehabilitation and physical therapy are optimal when assessment, monitoring, adherence to the therapy program and patient engagement can be achieved.
- Interactive therapy delivers and monitors with the use of Kinect virtual system that can quantitatively access the motion performed by the patients.
- To provide real time information about progress that will make the patients more confident and interested in exercising.

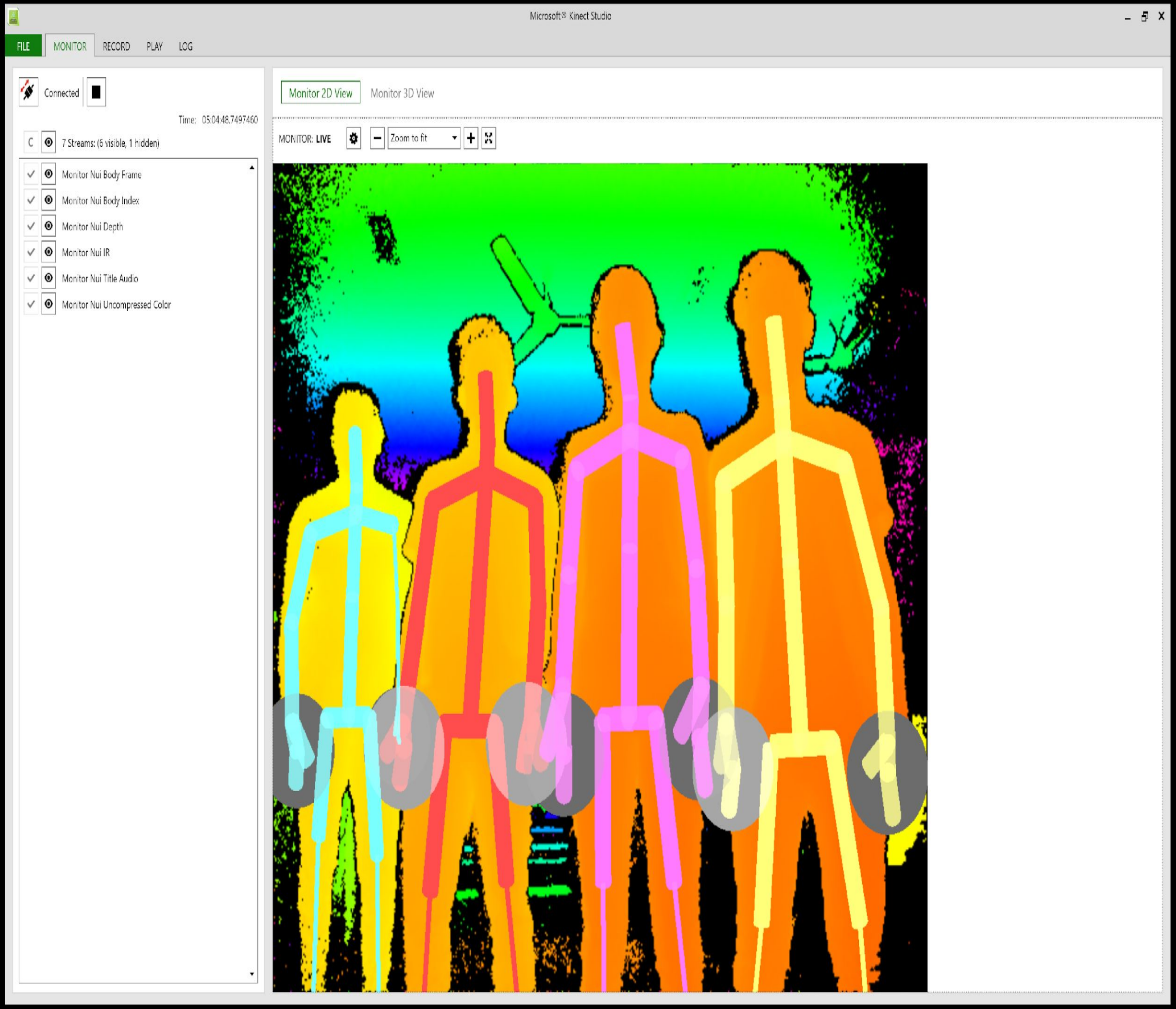
PROBLEM STATEMENT

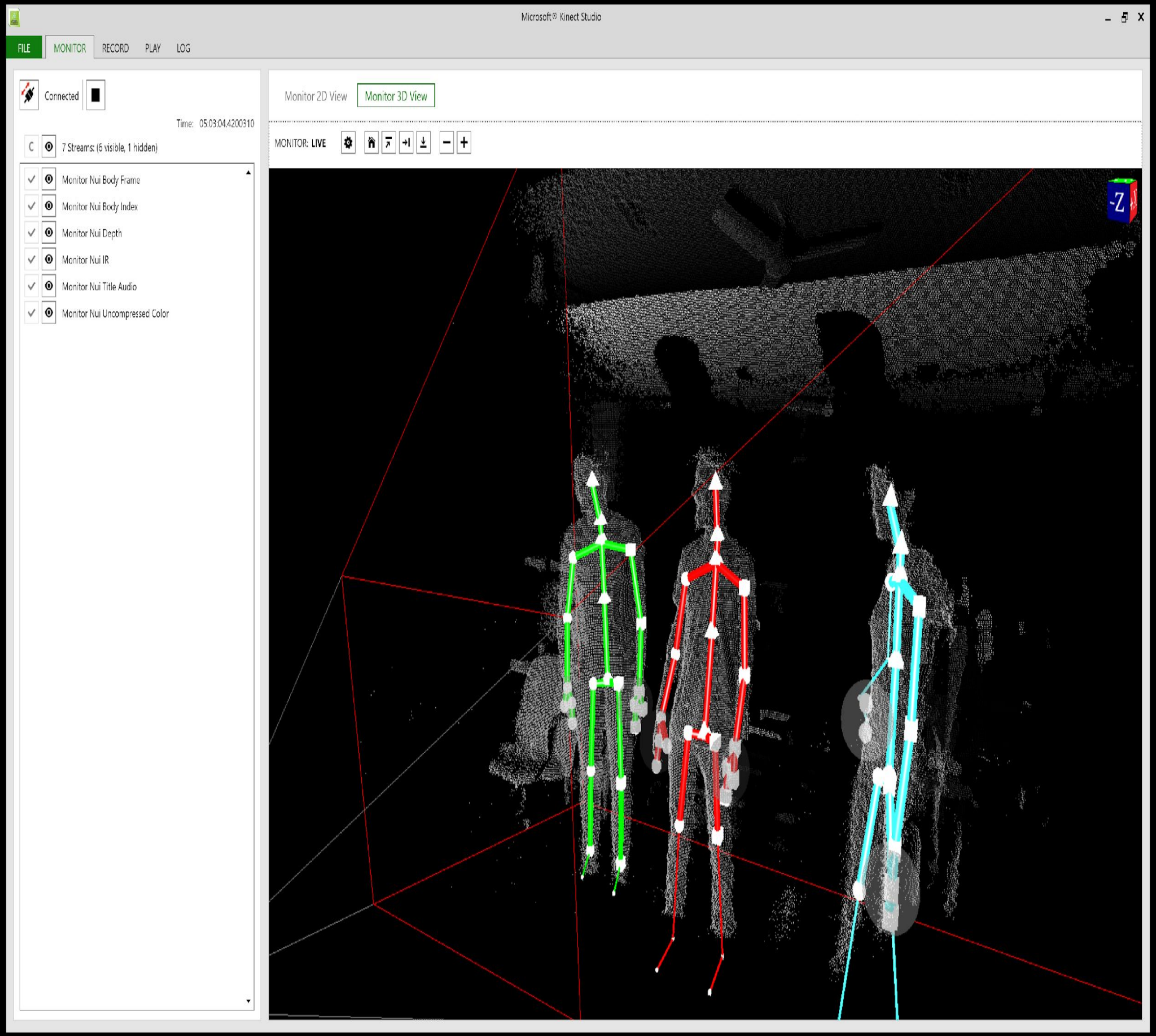
The traditional approach in medical science for physiotherapy is now been in practice since years and its been very tedious for the instructor and boring for the patient. With the advancement made in the field of technology a new concept of virtual reality can be used for physiotherapy in a way which patient may find interesting. Hence using this concept we intend to create an immersive experience to solve this problem.

Introducing Microsoft Kinect



Skelton Tracking

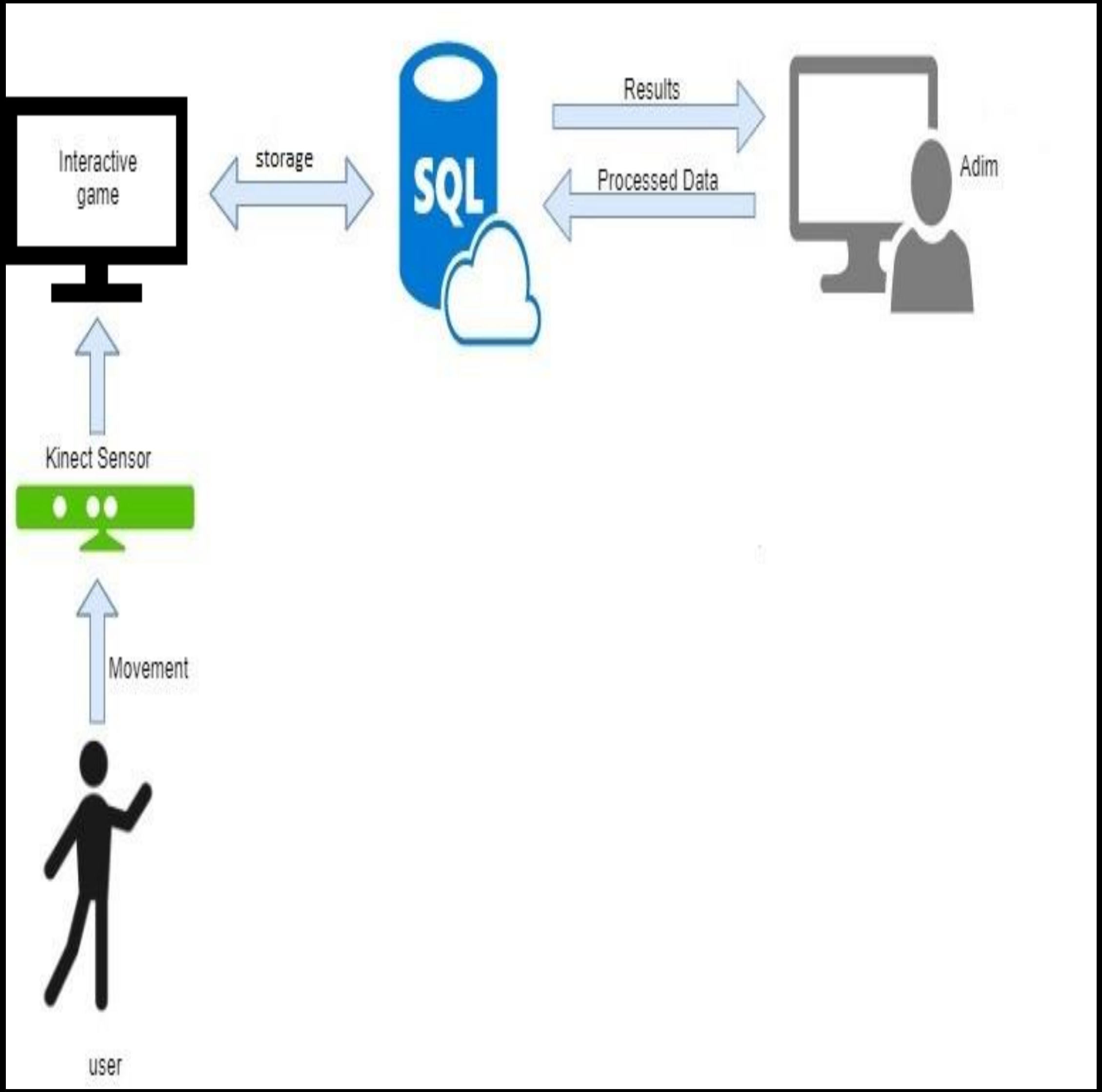




PROPOSED WORK

- This implementation will allow patient to perform different sets of exercises.
- Therapy programs can be performed in a virtual environment performing various exercises which will monitor and log patient execution.
- Monitoring and progress tracking improves patient understanding, motivation and helps in engaging more in these activities.
- The presented system can be implemented using Microsoft Kinect interfaced by unity3d.

DESIGN OF SYSTEM



SYSTEM REQUIREMENT

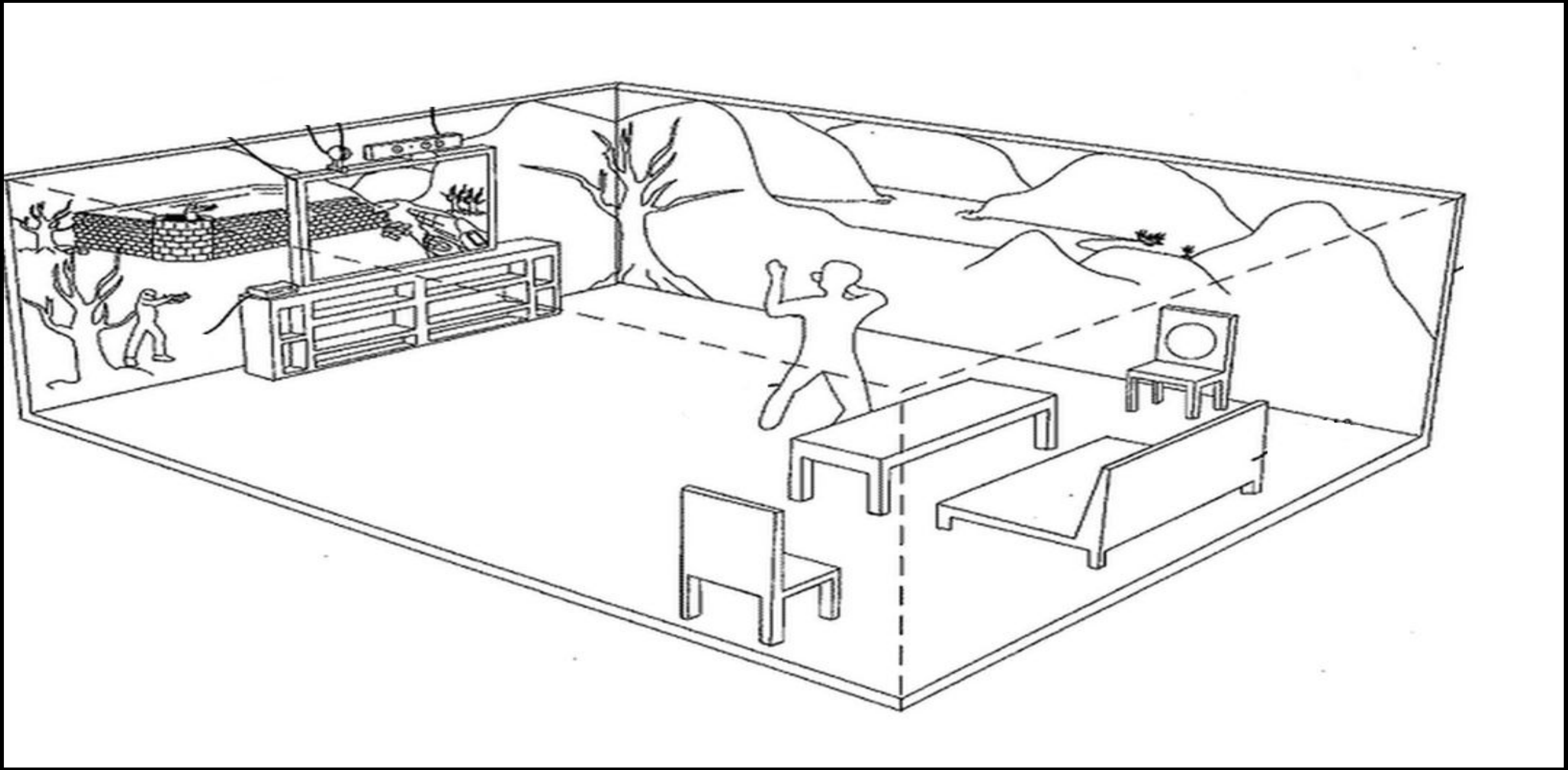
SOFTWARE REQUIREMENT:

- Unity 3D
- Microsoft Visual Studio 2015
- Microsoft Windows 10
- MySQL
- PHP
- Web Browser

HARDWARE REQUIREMENT:

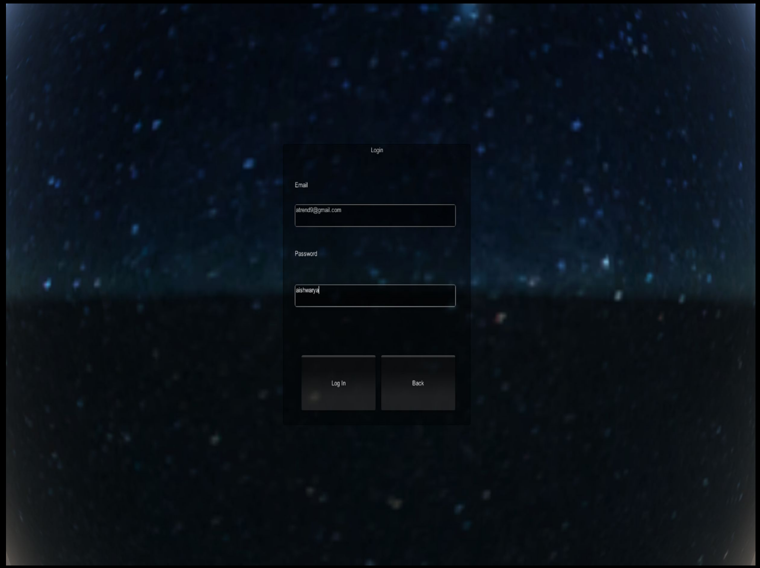
- Microsoft Kinect V2
- Kinect Windows Adapter
- Monitor
- Internet Connection

Healthcare Centre

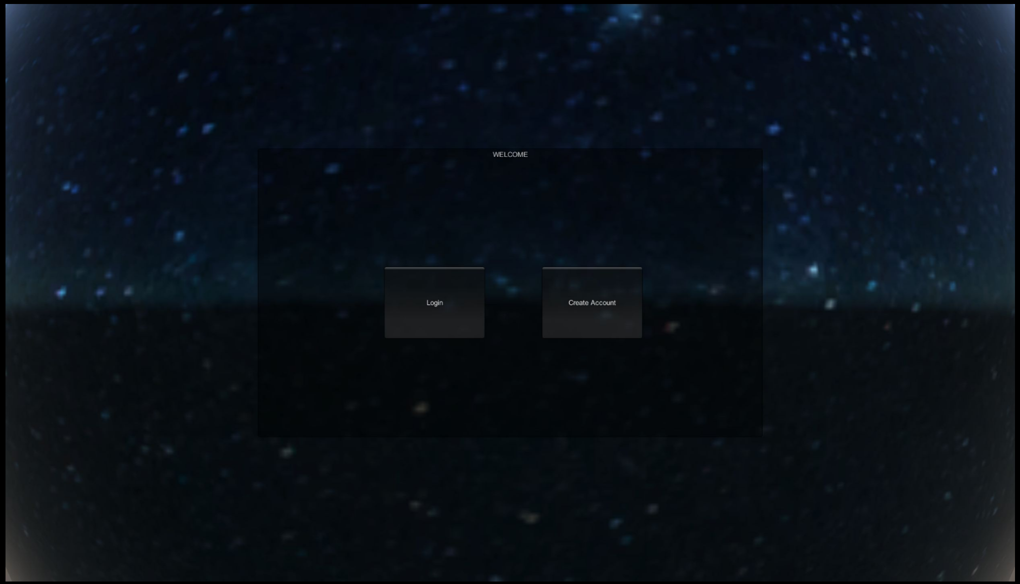


User Interface

User Login

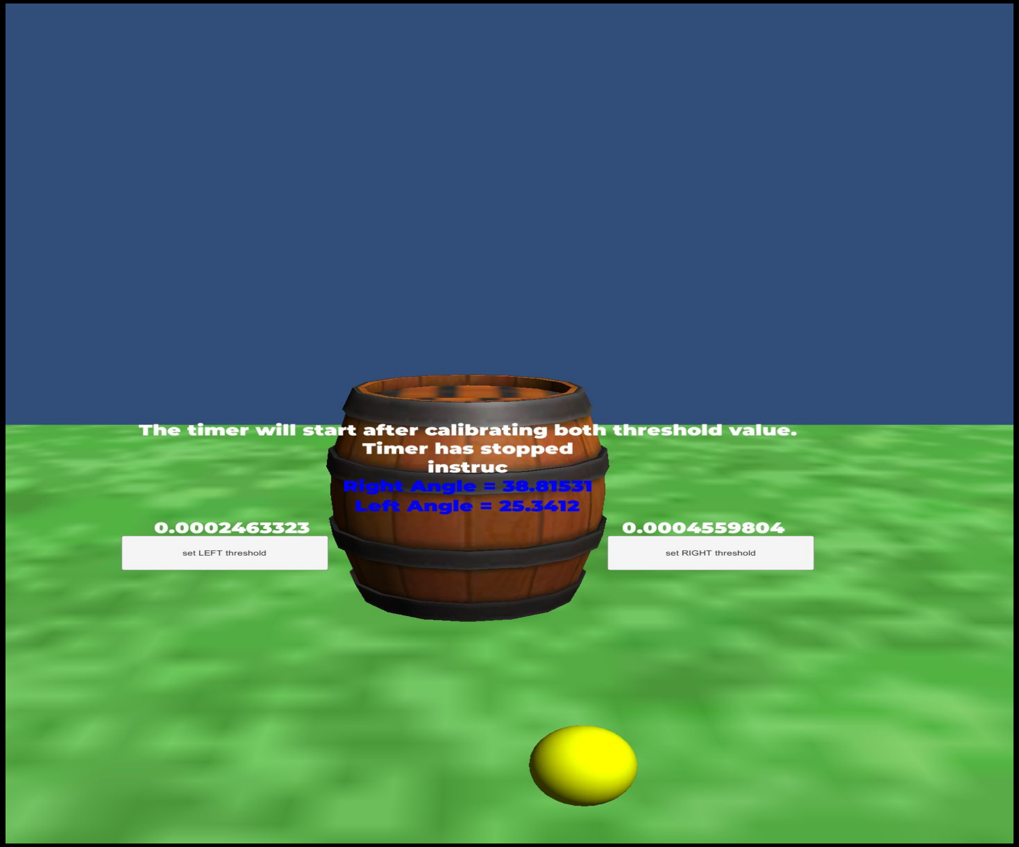


Welcome screen



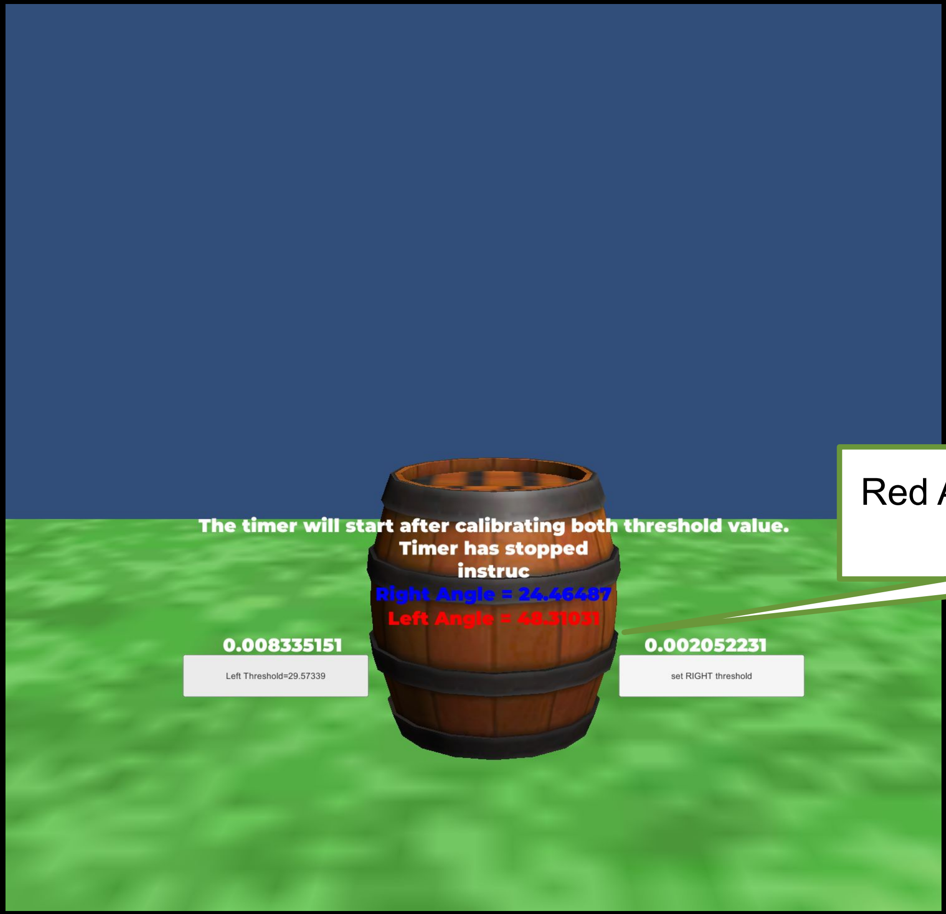
Gameplay

Game Screen



Camera view for user

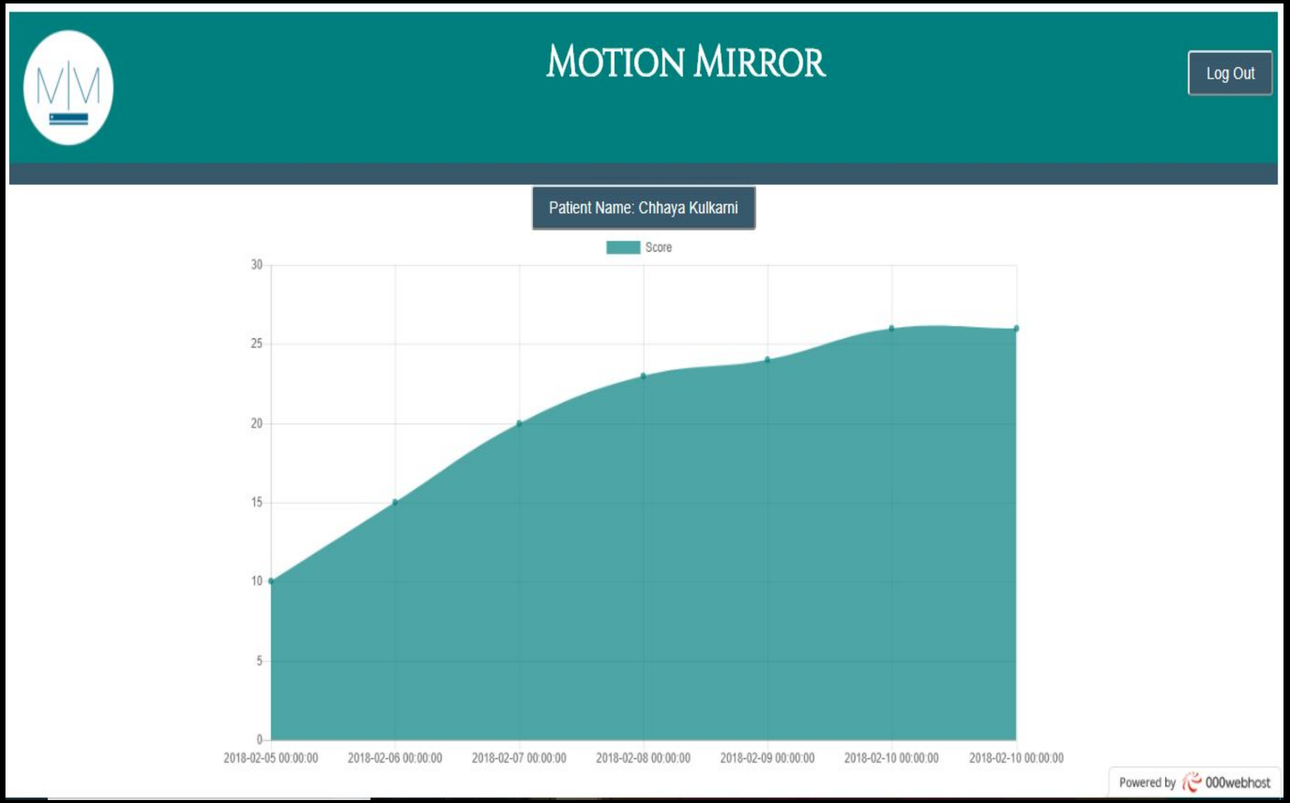
Intelligent Alert System



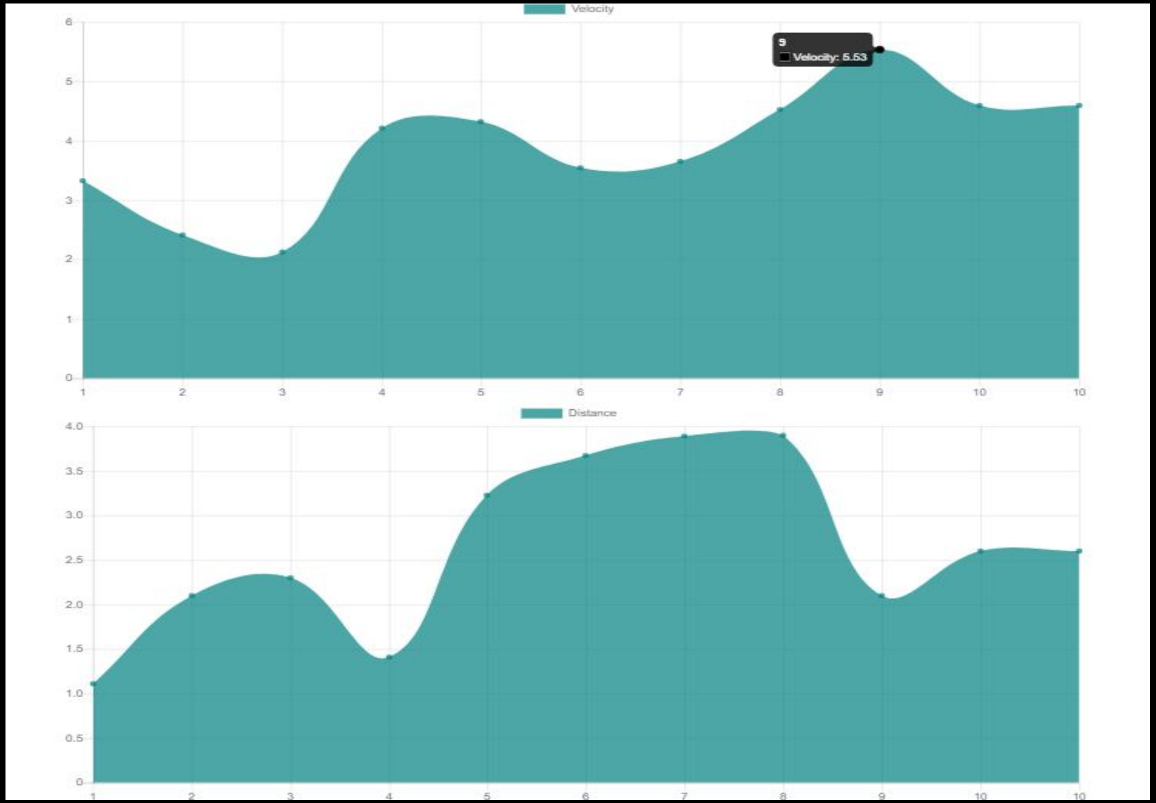
Red Alert against crossing threshold value

Outcomes

Final report



Graph per user



Angle Working

Angle calculation

```
public float calculateAngle(Vector3 oldpos, Vector3 steady, Vector3 newpos)
{
    float[] A = { oldpos.x - steady.x, oldpos.y - steady.y, oldpos.z - steady.z };
    float[] B = { newpos.x - steady.x, newpos.y - steady.y, newpos.z - steady.z };
    float v1mag = Mathf.Sqrt(A[0] * A[0] + A[1] * A[1] + A[2] * A[2]);
    float[] v1norm = { A[0] / v1mag, A[1] / v1mag, A[2] / v1mag };
    float v2mag = Mathf.Sqrt(B[0] * B[0] + B[1] * B[1] + B[2] * B[2]);
    float[] v2norm = { B[0] / v2mag, A[1] / v2mag, A[2] / v2mag };
    float res = v1norm[0] * v2norm[0] + v1norm[1] * v2norm[1] + v1norm[2] * v2norm[2];
    float angle = Mathf.Acos(res);
    float angle_in_degrees = angle * (180 / Mathf.PI);

    return angle_in_degrees;
}
```

Threshold alert

```
//right
Vector3 steady = GetJointPositionInv(userId, (int)KinectInterop.JointType.ShoulderRight);
    Vector3 newPos = GetJointPositionInv(userId, (int)KinectInterop.JointType.WristRight);
    Vector3 oldpos = new Vector3(steady.x, newPos.y, steady.z);
    rAngle = calculateAngle(oldpos, steady, newPos);

//left
Vector3 steadyleft = GetJointPositionInv(userId, (int)KinectInterop.JointType.ShoulderLeft);
    Vector3 newPosleft = GetJointPositionInv(userId, (int)KinectInterop.JointType.WristLeft);
    Vector3 oldposleft = new Vector3(steadyleft.x, newPosleft.y, steadyleft.z);
    lAngle = calculateAngle(oldposleft, steadyleft, newPosleft);
```

REFERENCES

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- Functional rehabilitation in Virtual Reality in industry (Doctor Kinetic)
- Professor. Wanda Stryla, Journal of Neurology and Neuroscience, Physical Education Academy named Eugeniusz Piasecki in Poznan, Poland, 2015.
- Grigore Burdea, Virtual Rehabilitation Benefits and changes, CAIP Center, Rutgers University,USA,2003.

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