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# VR medical gamification for training and education

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# VR, AR and Gamification

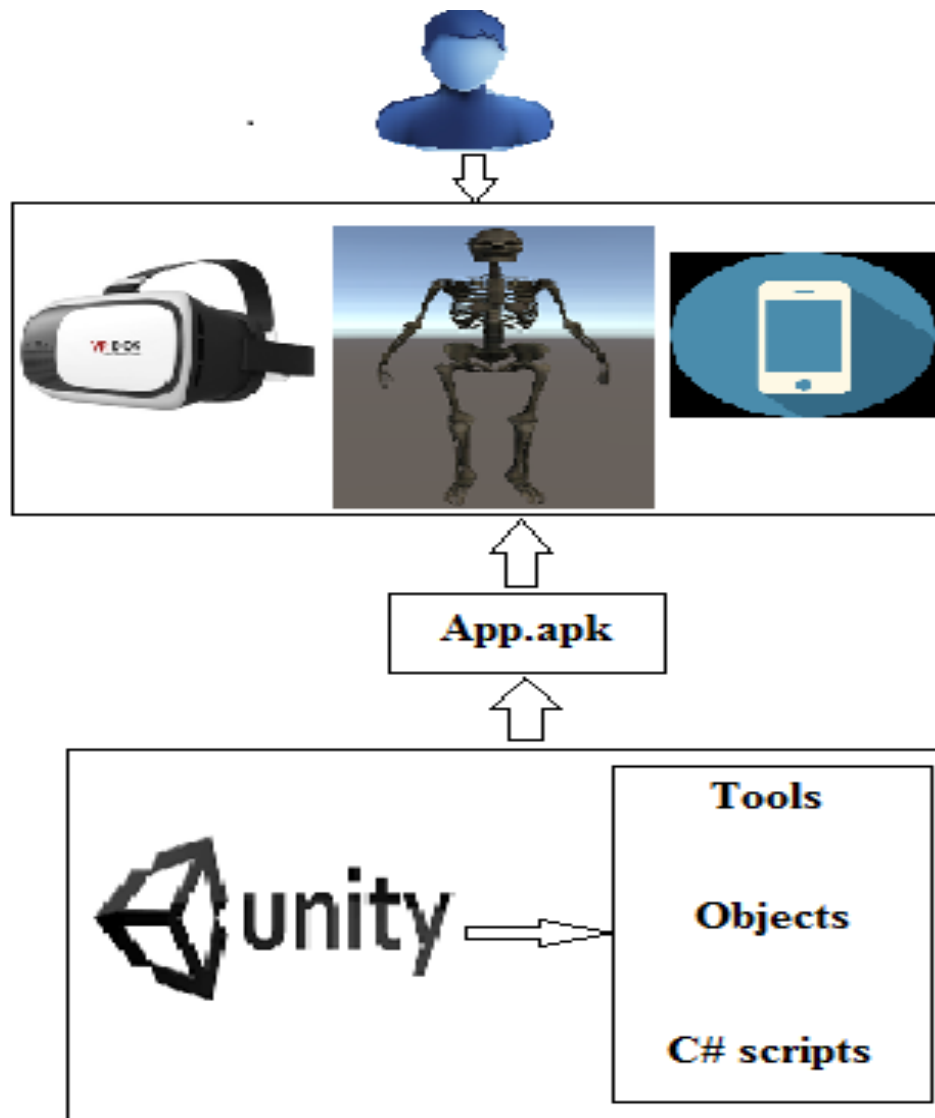


# State of the art

- Virtual reality Therapy for Adults Post-Stroke
- Virtual reality as an adjunctive pain control in burns caring for adolescent patients
- VR technology may serve as an effective non-pharmacological analgesic to aid pain management.
- Leap Motion supporting medical education – Skedu



# System architecture



# SkeduVR

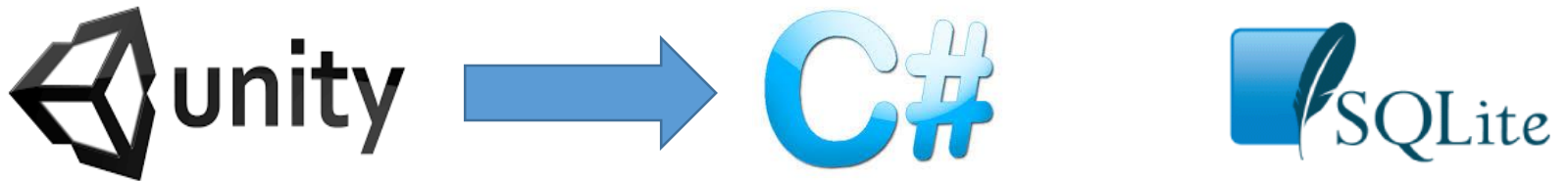
- complex mobile application supporting medical students to manipulate and learn the bones of a virtual human skeleton displayed in a virtual 3D scene

- development process
- results



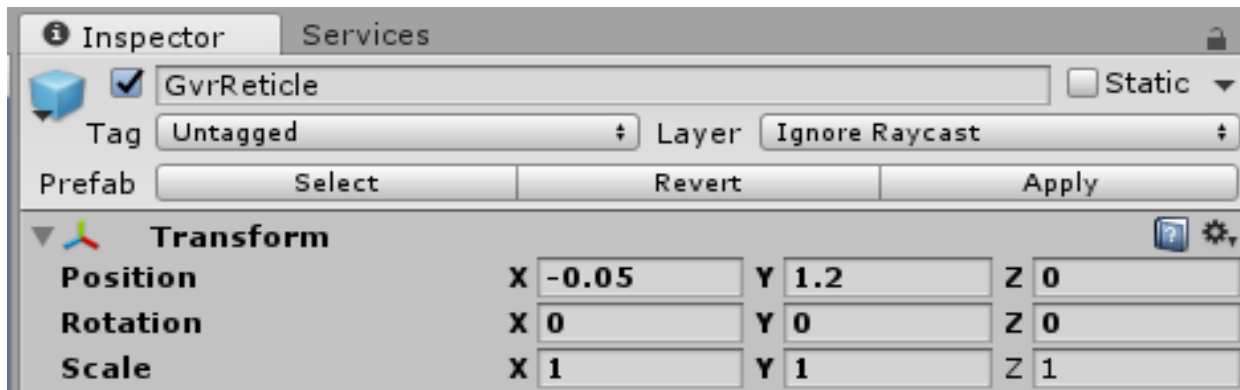
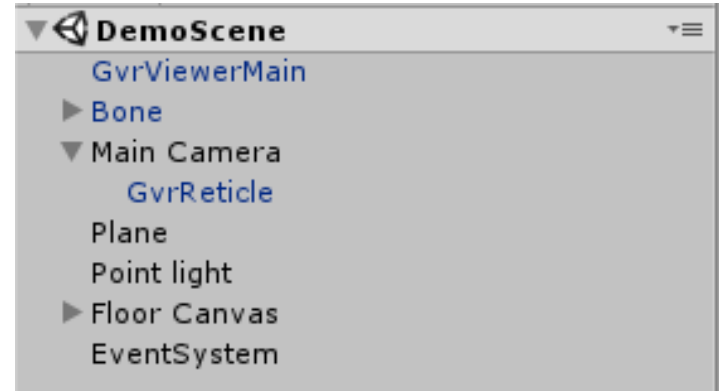
# Tools

- Unity 5.4 and C# scripts
- Google VR SDK
- SQLite



# Objects

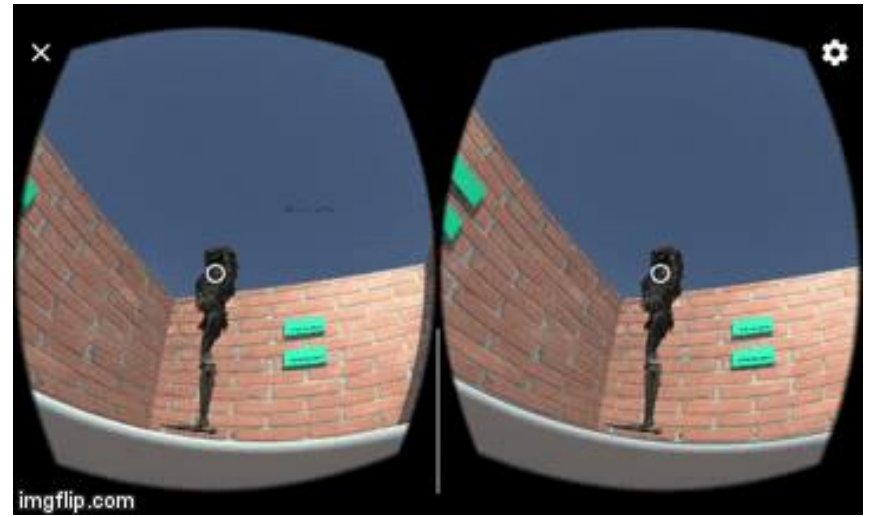
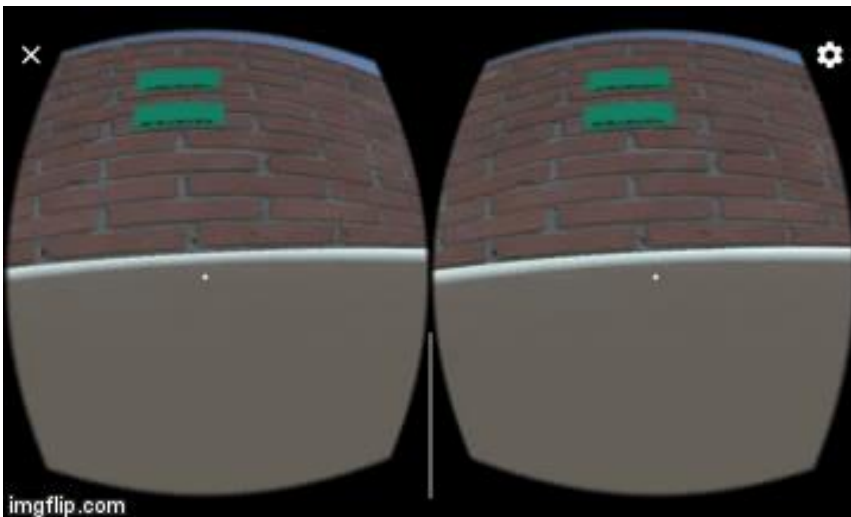
- Gvr Reticle
- Gvr MainCamera
- Bone
- Plane
- Point light, Text and Menu (3 buttons)





# Main functionalities

- Turning On and Off the spin of the skeleton
- Selected bone information
- Movement in 3D space.
- Reset current position in the virtual 3D space



# Methods

- *Spinning equation (rotating the object):*

$$R = m_i + k;$$

where:

$m_i$  - represents the measure of the angle of rotation at moment  $i$  ( $i = 1 \rightarrow n$ ;  $n = 8$ );

$k$  - constant angle of  $45^\circ$ ;

$R$  - measure of the angle of rotation.

*Table 1. Measure of the angle of rotation  $R$  for one rotation:*

$i$	$m_i$	$k$	$m_i + k$	$R$	Rotation number $i/n$
1	$0^\circ$	$45^\circ$	$0^\circ + 45^\circ$	$45^\circ$	$1/8$
2	$45^\circ$	$45^\circ$	$45^\circ + 45^\circ$	$90^\circ$	$2/8$
3	$90^\circ$	$45^\circ$	$90^\circ + 45^\circ$	$135^\circ$	$3/8$
4	$135^\circ$	$45^\circ$	$135^\circ + 45^\circ$	$180^\circ$	$4/8$
5	$180^\circ$	$45^\circ$	$180^\circ + 45^\circ$	$225^\circ$	$5/8$
6	$225^\circ$	$45^\circ$	$225^\circ + 45^\circ$	$270^\circ$	$6/8$
7	$270^\circ$	$45^\circ$	$270^\circ + 45^\circ$	$315^\circ$	$7/8$
8	$315^\circ$	$45^\circ$	$315^\circ + 45^\circ$	$360^\circ$	$8/8$

# Methods

- Spinning off equation (*not rotating the object*) :

$$R = m_f + k;$$

where:

$m_f$  - is the measure of the angle of rotation in the final moment  $f$  ( $f = 1 \rightarrow n$ ;  $n = 8$ );

$k$  - constant angle of  $0^\circ$ ;

$R$  - measure of the angle of rotation (angle equal measure when finally  $m_f$ ).

- Movement equation:

$$P_{fc}(x_f, y_f, z_f) = P_{ic}(x_i, y_i, z_i) * s; \quad (x_f > x_i, y_f = y_i, z_f > z_i)$$

where:

$P_{fc}(x_f, y_f, z_f)$  - the final position of the camera on coordinates  $x, y, z$ ;

$P_{ic}(x_i, y_i, z_i)$  - the initial position of the camera on coordinates  $x, y, z$ ;

$s$  - constant vector speed

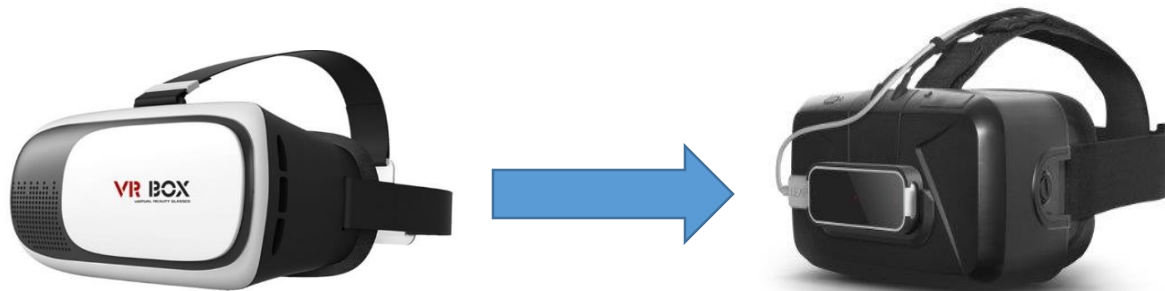
# Discussions and conclusions

- **Android 4.2** << Android 5.1 << Android 6.1
- The distance between headset and the mobile phone and the distance between the two lenses -> mechanically buttons
- Installing the application on mobile phones is easy, being the same as for any other regular applications



# Discussions and conclusions

- Gamification, the concept that the application is based on, offers to users the possibility to learn and control the bones of the human skeleton in a realistic mode.
- The application enables the users to learn the bones of the human skeleton in an interactive way and a realistic 3D environment.
- App.apk 1.1 (VR) -> App.apk 2.1 (AR)





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