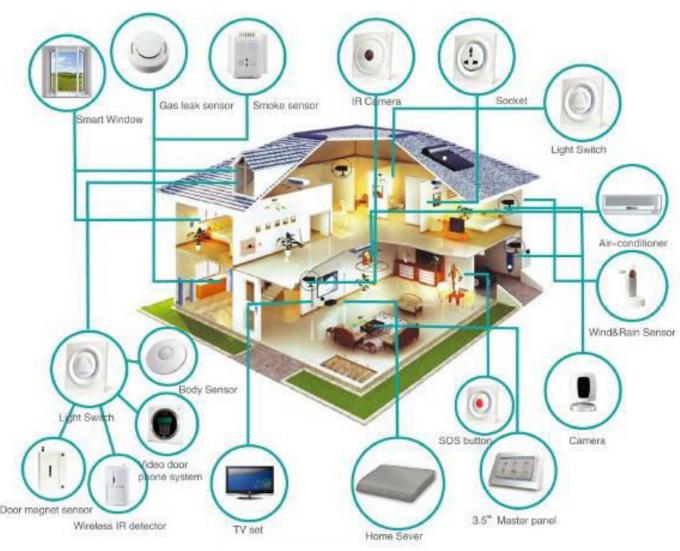
WorkPackage1: A Smart Home for Disabled: Occupational Therapy Perspective

Smarthome appliance controlling can be turned into occupational therapy





WorkPackage1: A Smart Home for Disabled: Occupational Therapy Perspective

Therapist can define gesture to control devices based on patient improvement metric

Developed Smartphone app called "SmartOT", which will allow a patient to control the appliances accordingly.

All the interaction with the appliances are recorded by the big data repository

Real-time or offline forward and inverse kinematic analytical Data is available for patient and therapist





WorkPackage1: A Smart Home for Disabled: Occupational Therapy Perspective

VIDEO DEMONSTRATION

Challenges

- Most of the physiotherapy patients perform exercises at home incorrectly.
- A therapist cannot know if the patient has done exercise at home or if she has done it correctly.
- Small amount of improvement gained by performing exercise done at home cannot be measured.
- Hence, the improvement pace is compromised.

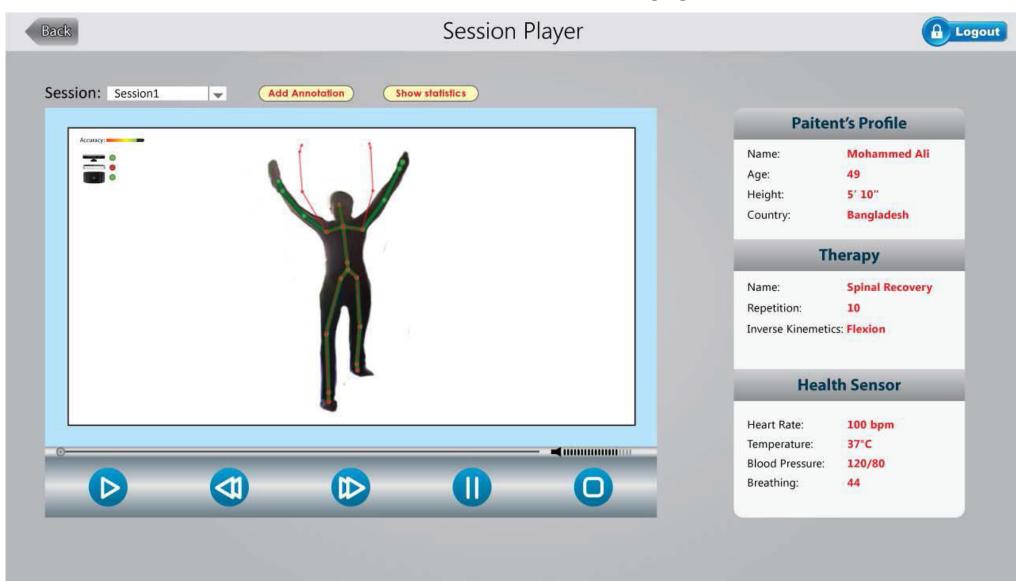
Solution

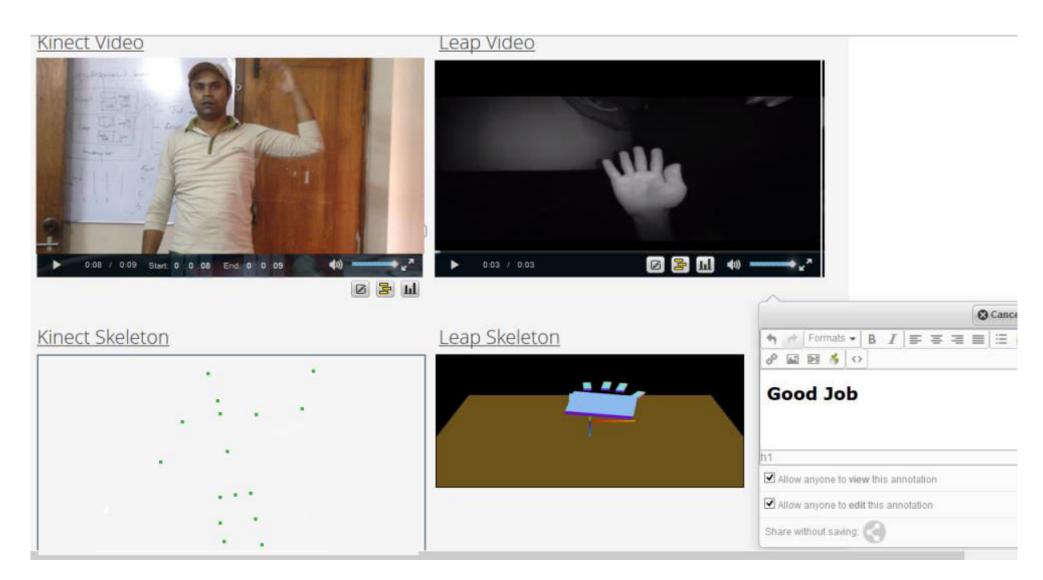
- We have devised a solution to enable therapists to monitor and guide their patients remotely.
- Therapists can create therapies, record them and upload them to the cloud.
- Patients can download therapies at home and practice them with visual cues for self correction.
- The therapy session performed by the patient at home is monitored to detect different activities such as beginning and ending of a repetition and calculate the time, speed and min and max range of motion of different joints taking part in the activity.

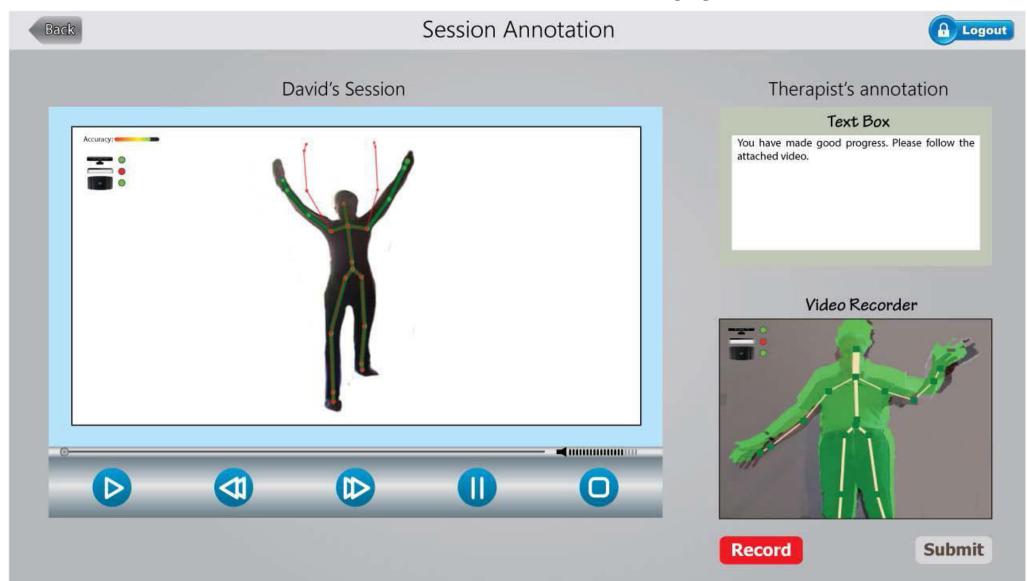
Solution

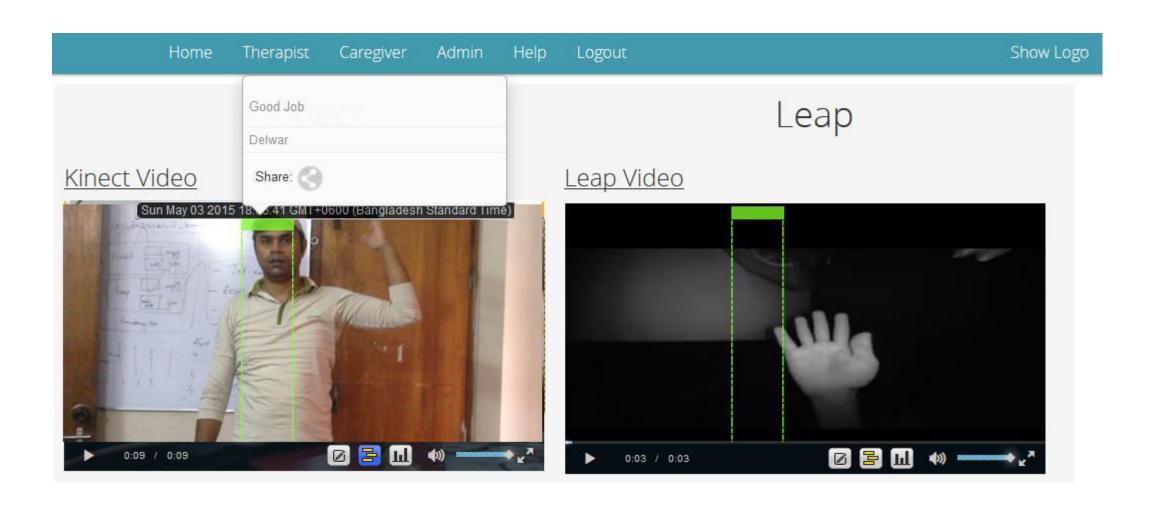
- The system can report to the therapist all the activity performed by the patient at home.
- The therapist as well as the patient and her community of interest can view complete analysis of the patient's recovery process.
- **Big Data** analytics can be used to study and discover new recovery parameters.





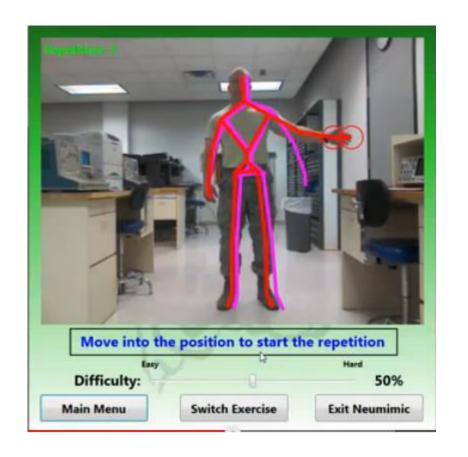


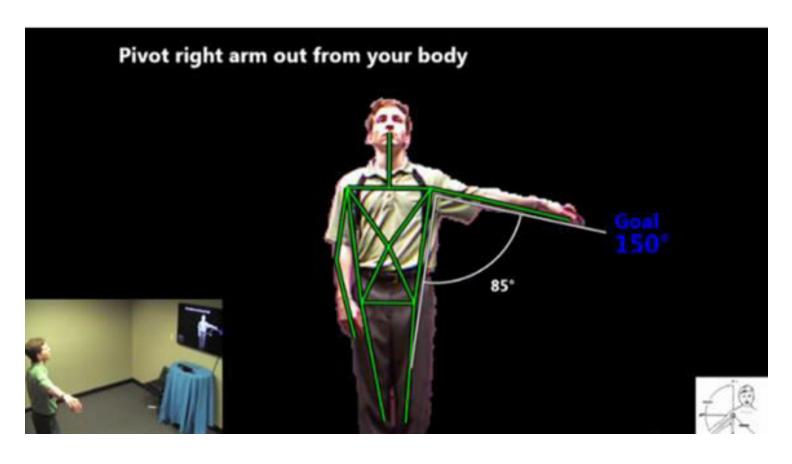




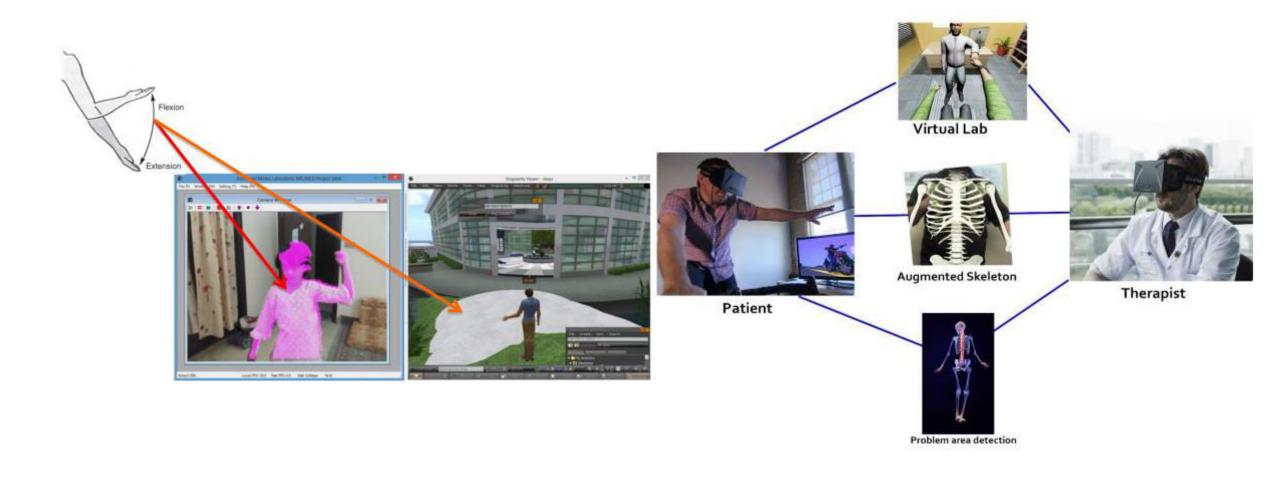
VIDEO DEMONSTRATION

Solution1: Augmented Reality



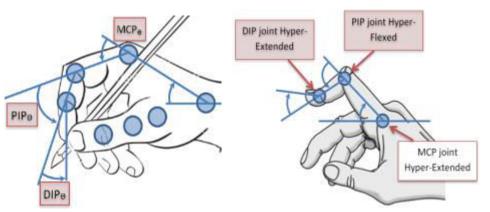


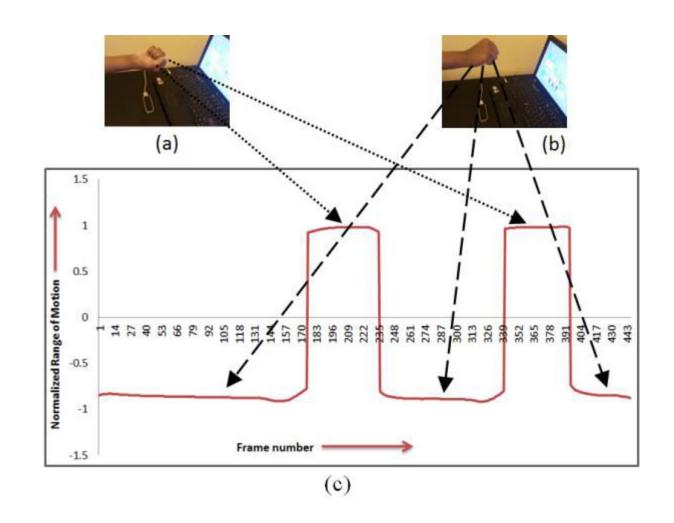
Solution2: Virtual Reality



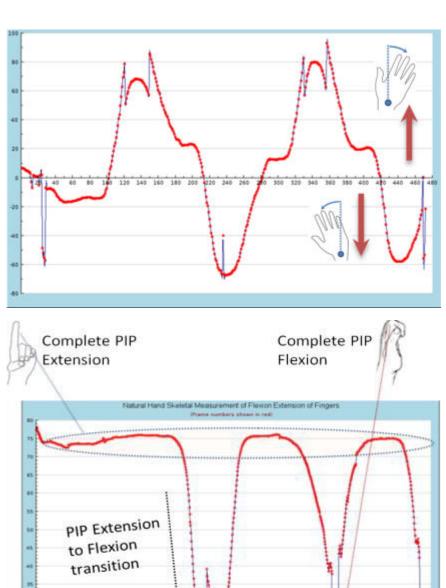
In-home Therapy in Action:

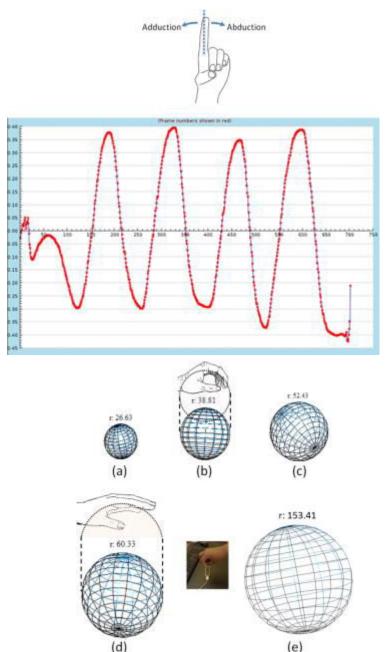




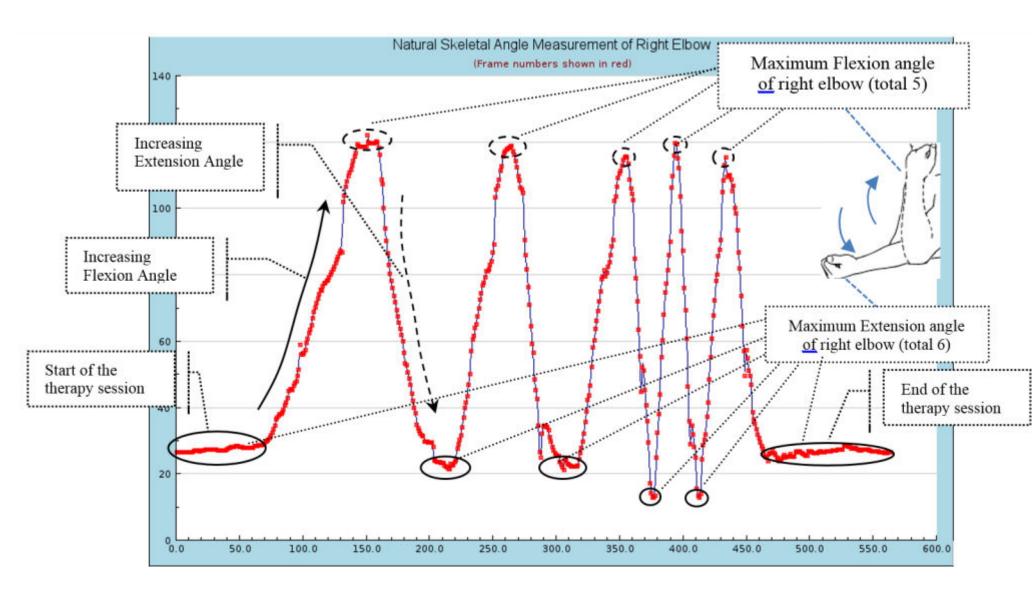












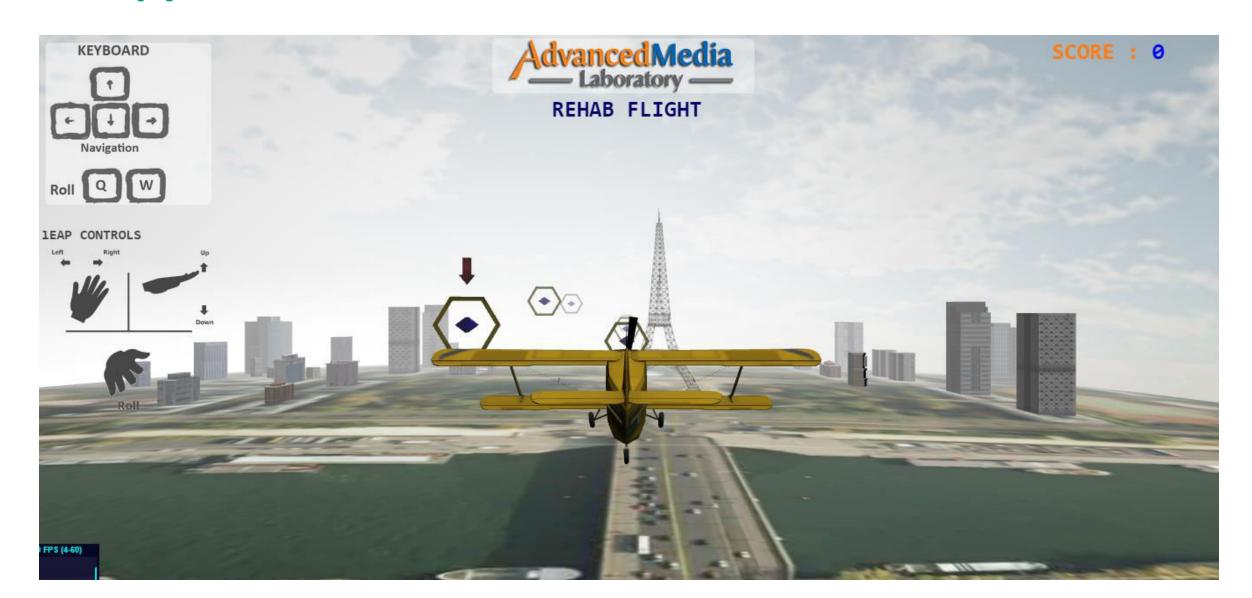
VIDEO DEMONSTRATION

Problems:

- Physiotherapy exercises are boring.
- Forcing young disabled children to perform exercises can be specially challenging.
- Two thirds of the patients do not perform exercises correctly at home.
- A therapist has no way of knowing if a patient performed exercises at home correctly or not.
- There is no way for a therapist to correct a person performing exercise at home.
- Recovery in many patients is slow and cannot be measured accurately by instruments currently in use.

Solution:

- We have developed an online flying game that can be played by a patient using hand and body gestures.
- The gestures used to play the game are the ones required to perform physical therapy.
- The therapist can customize the game with required gestures and difficulty level, depending on the current state of the patient.
- Off the shelf multi-sensory environment will allow patients to play the games while the kinematic data will be available to the doctor for further analysis and deciding quality of improvement.

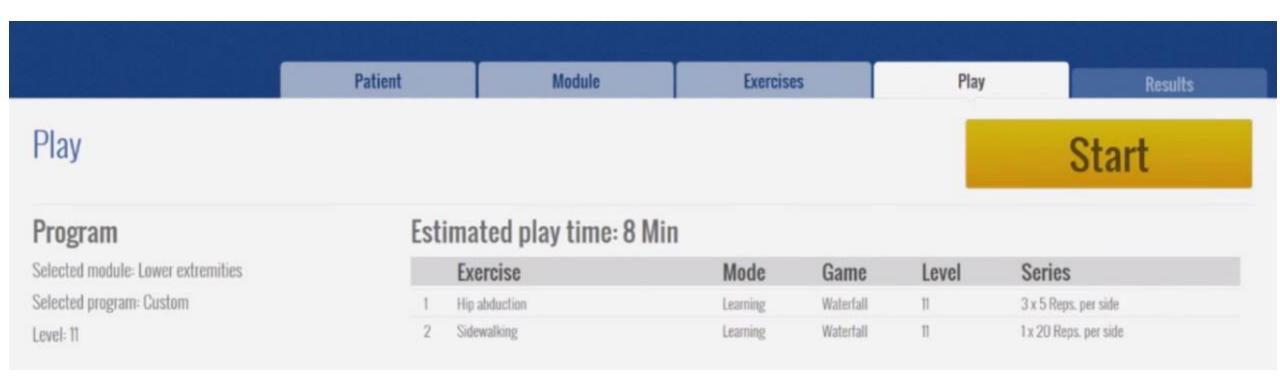


Therapy









Dashboard Analytics

Profile			Performance Data				Program Management			
Favorites Since Beginning Past Year Past 6 Months Past 3 Months Past Month Past Week	Program Session - 7:4 Total Time Spent: Session Performance Ra Total score: Average score:	8 minutes								
	Title		Scenario	Duration	Number of levels	Performance Rating	Activity Rating	Average score	Total score	
	Shoulder mobility		Fish Frenzy	0:00:59	3	40	96.72	380.3	1141	
Sessions	Trunk strength		Sitting Balance	0:05:45	1	40	100	100.0	100	
3/20/2013 7:44:24 PM	Exercise targeting elbow flexion		Pixel Waves	0:00:58	2	40	100	700.0	1400	
Shoulder mobility	Bilateral clapping activity		Pop Clap	0:00:57	2	40	100	350.0	700	
Trunk strength Exercise targeting elb Bilateral clapping activ 3/19/2013 3:44:24 PM 3/17/2013 7:42:24 PM 3/16/2013 4:38:24 PM 3/15/2013 5:47:24 PM 3/11/2013 6:39:24 PM 3/10/2013 7:40:24 PM 3/10/2013 6:38:24 PM										

VIDEO DEMONSTRATION

Problems:

- Disabled people are not always able to use the keyboard properly.
- Entering passwords is a special problem.
- Slow entry can allow others to see the password.
- Doctors in clinical environment wants hands-free access to computers in cases where hands are engaged.

Solution:

- We have developed a multi-sensor based password entry environment for the physically challenged that allows users to log in using hand gestures.
- The gestures can be detected even in a dark room using only an infra-red light or through reading the EMG signals produced by muscle activity due to movement of hand.
- This can be used at ATM Machines.





Left Hand Gestures

Right Hand Gestures

VIDEO DEMONSTRATION

WorkPackage5: Gesture Based Browsing

Solution:

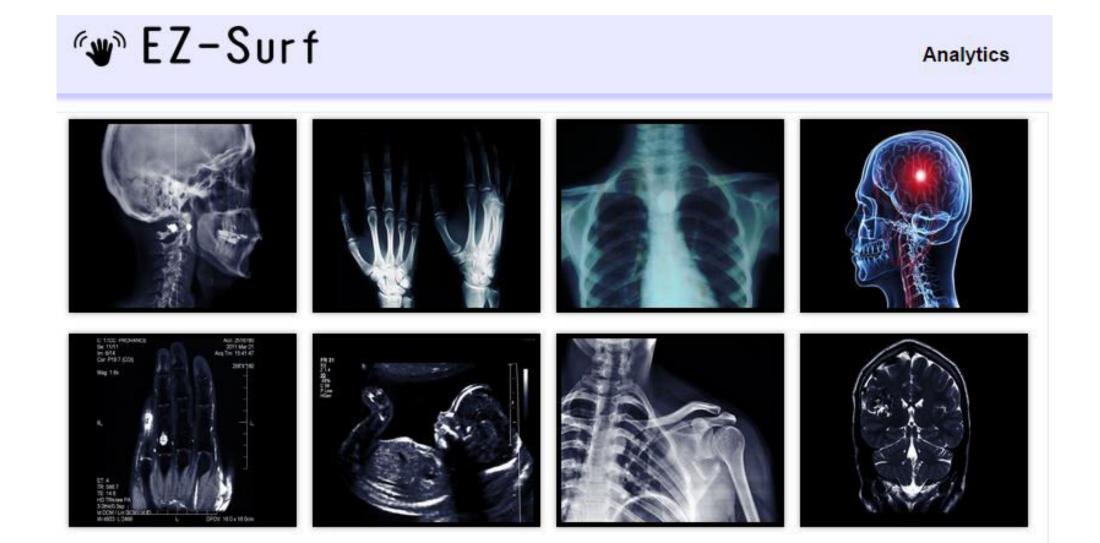
- We have developed a solution to browse the internet using gestures.
- We use smart sensors that detect gestures performed by the user with her hands in the air and convert them to mouse and keyboard clicks and events.
- We can use different kind of devices to detect different kind of gestures and use them for browsing.

WorkPackage5: Gesture Based Browsing

Solution:

- We can configure the gestures according to the type of disability of each user.
- Each user can select the gestures she feels most comfortable with and use them for the required tasks.
- We can also configure the sensitivity of each gesture through software according to the level of disability of each patient.

WorkPackage5: Gesture Based Clinical Data Browsing



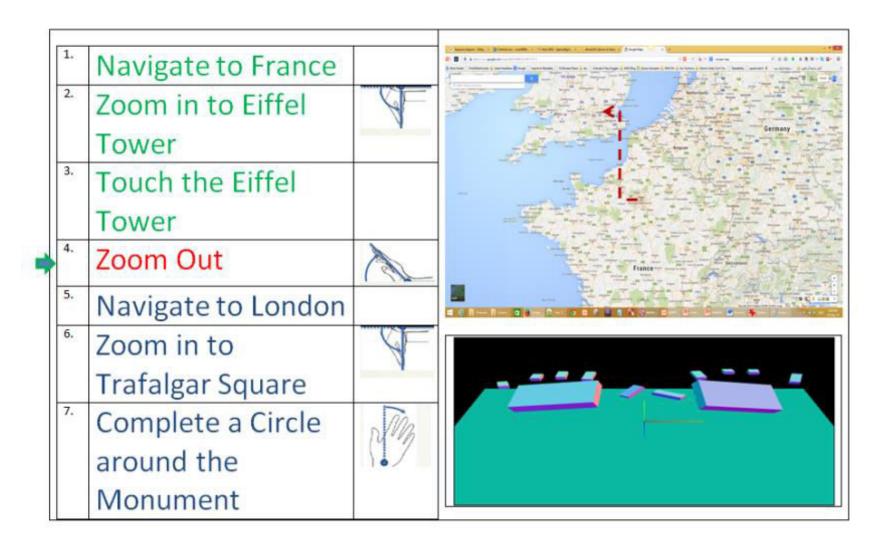
WorkPackage5: Gesture Based Clinical Data Browsing



WorkPackage5: Gesture Based Clinical Data Browsing



WorkPackage5: Gesture Based Map Browsing



WorkPackage5: Gesture Based Browsing

VIDEO DEMONSTRATION

WorkPackage7: Complete Multimedia e-Therapy Framework

Problem:

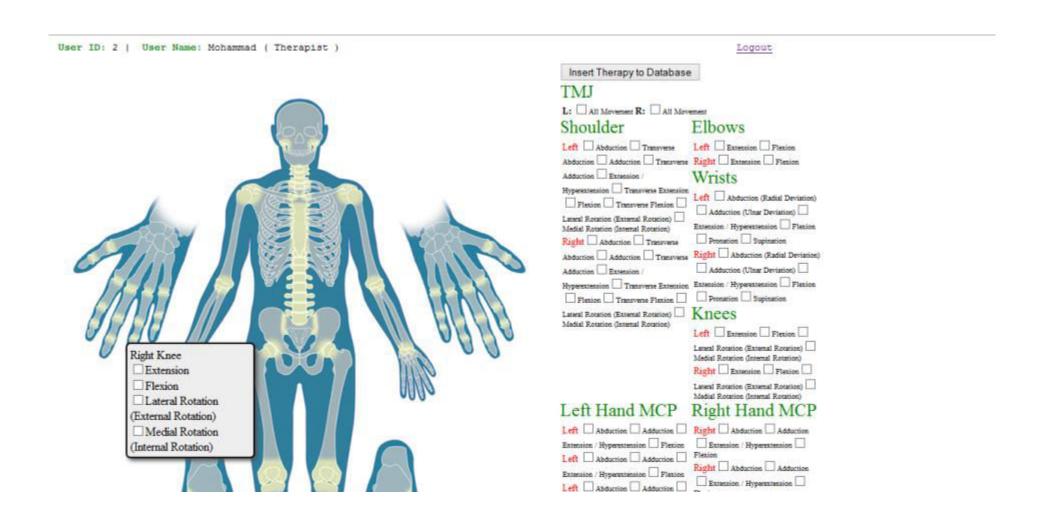
- Most of the patients perform exercise incorrectly at home
- A therapist cannot know for sure if the patient performed any exercise at home or not and if the exercise was performed correctly or not
- Minor improvements in exercise cannot be measured by goniometers

WorkPackage7: Complete Multimedia e-Therapy Framework

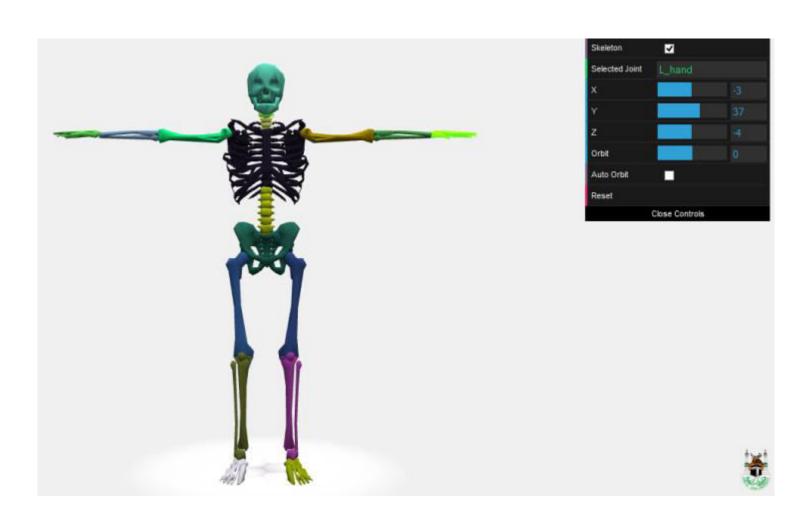
Solution:

- We have devised a web application that reports the angles made by 25 different joints in the human body 30 times per second.
- A therapist can easily design a therapy by specifying the joints of interest in the body. The system will filter joint data based on therapy related joints.
- A 3D skeleton can be used by the therapist to explain the patient the inner details of his ailment.
- The system can also provide live feedback using Augmented Reality or Virtual Reality to a user showing the range of motion of each joint in his body.

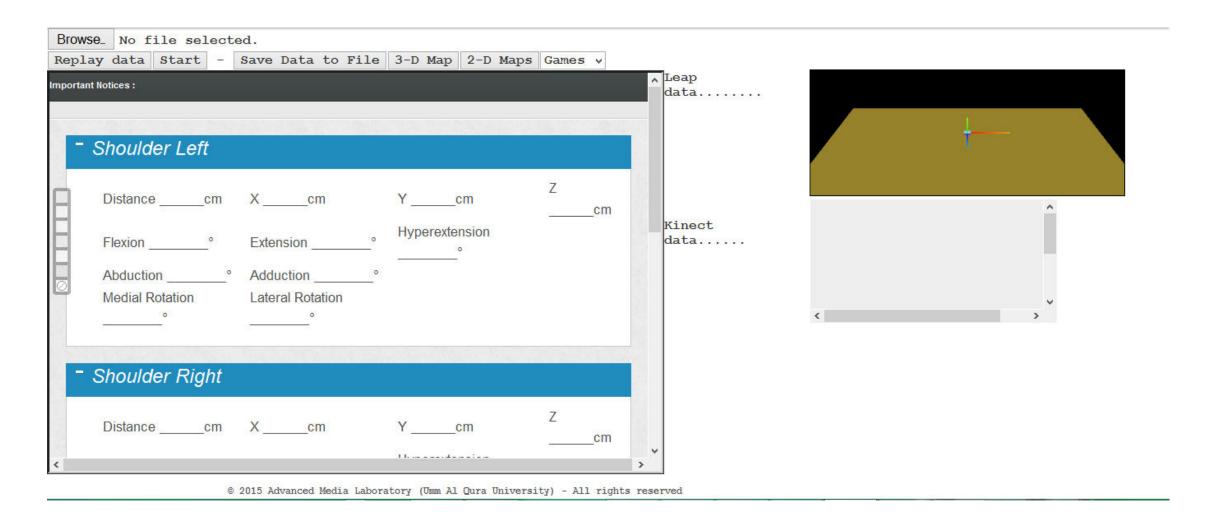
WorkPackage7: Personalized Therapy Creation



WorkPackage7: Educate Therapy Using Gesture-Based Interactive 3D Skeleton



WorkPackage7: Whole Body Range of Motion



WorkPackage8: Big Data Support for e-Health Applications

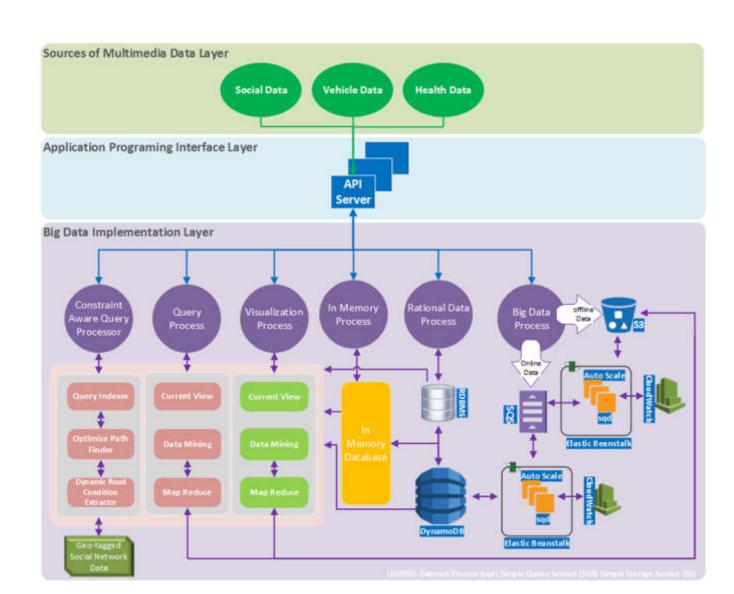
Problem:

- Health sensors, text messages, audio and video sessions, 3D imagery, skeletal data from sensor are very large.
- One minute of therapy session can require more than 200 MB of space.
- Storing these large volume of multimedia e-Health data from millions of users...
- Requires big data repository

WorkPackage8: Big Data Support for e-Health Applications

Solution:

Multimedia Spatial Hadoop



WorkPackage8: Big Data Support for e-Health Applications

VIDEO DEMONSTRATION

Problem:

- Many pilgrims cannot find a medical center.
- Most of them cannot explain their ailment due to language issues.
- Even if they know where to go, they cannot find the route to their destination due to traffic problems in Haj.
- Pilgrim Social Network

Solution:

- We have devised a suite of mobile app that helps pilgrims update hajj agency and medical institutions about the condition of the patient.
- Latest traffic conditions help ambulance driver find his way and the patient in realtime using multimedia routing.

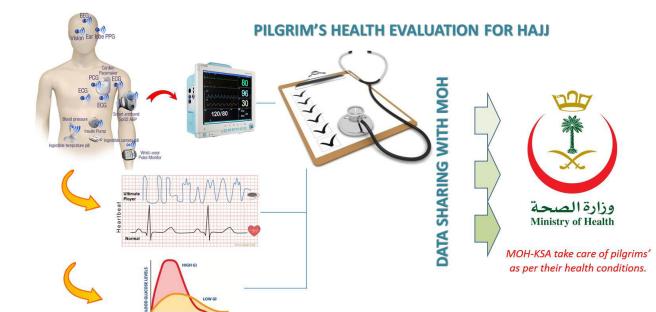
Pilgrim Social Network:



Pilgrim Health Data Sharing

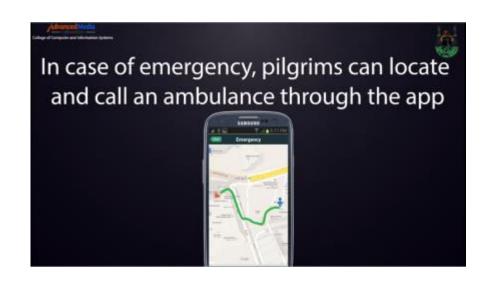


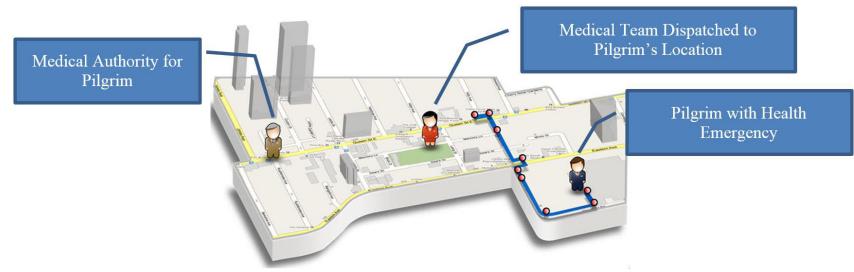




WorkPackage6 - Pilgrim Locating an Health Services







Optimize route navigated to Medical team towards the pilgrim

VIDEO DEMONSTRATION