

List of Presentations held on 7th September 2016

1. A-VIEW Phase II.....	2
2. Development of National Digital Library of India.....	56
3. Learning by Doing (LbD) based course content development in areas of CS and ECE.....	86
4. Main Phase Project Proposal on Development of Indian Sign Language Education and Recognition Platform for Hearing Impaired Students of India....	96
5. Development of an Indian Sign Language Education & Recognition Platform for Hearing Impaired Students of India.....	129

A-VIEW Phase II

Kamal Bijlani
Amrita University



A-VIEW

Amrita Virtual
Interactive E-learning World

- 10,000 + colleges connected
- Global Recognition by Cisco
- Over 1 crore training hours



Supported by
National Mission on Education
(NME-ICT), Ministry of HRD

Developed by
Amrita University



Partners
IIT Bombay



Partner s
IIT Madras



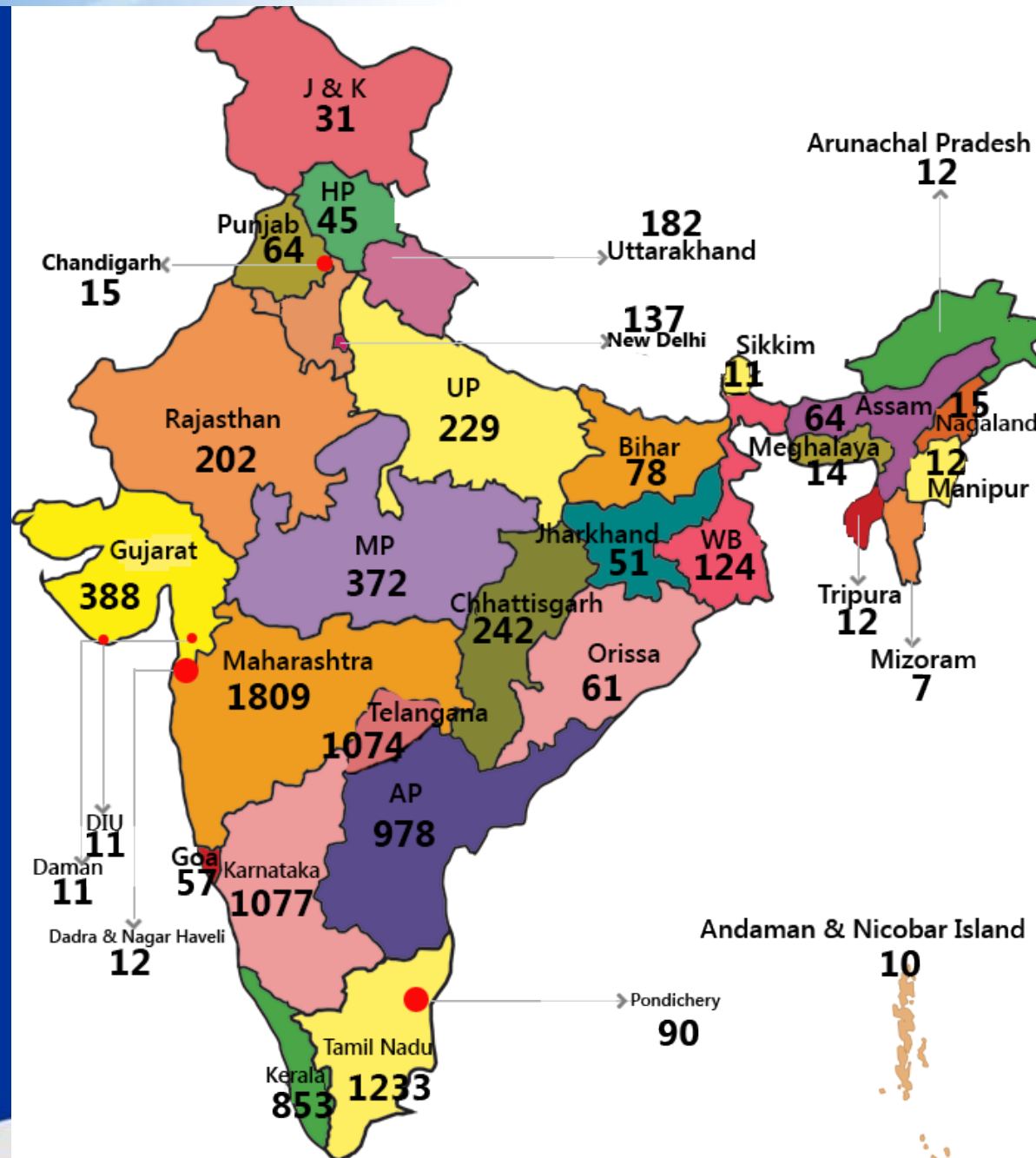
Partners
IIT Kharagpur

www.aview.in, aview@amrita.edu
+91 476 280 4405, +91 94470 51380

Table of Contents

- Phase I Accomplishments
- Phase II Objectives
- Phase II Budget & Deliverables

A-VIEW Usage – 10,000 Institutions



A-VIEW Phase II

Phase II

- Crores benefited
- 25,000 Institutions (Higher Edu)
- Large Scale: Schools, Skill Training

Phase I

- Lakhs benefited
- 10,000+ Institutions (Higher Edu)
- Pilots: Schools, Skill Training



A-VIEW Phase II Vision: Crores of Users



Massively
Scalable
Live Interactive
Collaborative
E-Learning
Platform

तस्वकी को चाहिए नया नजरिया

शिक्षकों के लिए बनेगा प्रौद्योगिकी ट्रेनिंग सेंटर

हल्द्वानी | कार्यालय संवाददाता

शिक्षकों को शिक्षा की नयी तकनीक की जानकारी देने के लिए हल्द्वानी में एकेडमिक ट्रेनिंग सेंटर बनेगा। उच्च शिक्षा मंत्री डा. इंदिरा हृदयेश ने उत्तराखंड मुक्त विवि में यह सेंटर खोलने की बात कही है।

मंगलवार को उत्तराखंड विज्ञान एवं प्रौद्योगिकी संस्थान, उच्च शिक्षा विभाग और यूओयू की ओर से एमबीपीजी कार्गुलेज में प्रौद्योगिकी के प्रयोग से उच्च शिक्षा को सुसज्जित करने पर कार्यशाला का आयोजन हुआ। इस दौरान डा. हृदयेश ने कहा कि गेटवे आफ कुमाऊं हल्द्वानी को ई-गेटवे आफ कुमाऊं बनाने की जरूरत है। बताया कि सरकार जल्द ही आईटी एकेडमी भवन बनाएगी, जहां छात्र डिजिटल तरीके से पढ़ाई कर सकेंगे। अंतर्राष्ट्रीय मामलों के जानकार प्रो. पुष्पेश पंत ने कहा कि यूओयू तकनीक के इस्तेमाल में आगे है इसलिए अब एकेडमिक ट्रेनिंग सेंटर हल्द्वानी में बनना चाहिए। यूओयू के प्रो. दर्गेश पंत ने कहा



हल्द्वानी में मंगलवार को आयोजित कार्यशाला में वित्त मंत्री इंदिरा हृदयेश और अन्य। • हिन्दुस्तान

कुलपति प्रो. नागेश्वर राव, उच्च शिक्षा निदेशक डा. बीसी मेलकानी, ग्रुप कैप्टिन अशोक कटारिया, गोविन्द बल्लभ, पंत विश्वविद्यालय के पूर्व कुलपति प्रो. बीएस बिष्ट, अमृता विश्वविद्यालय के प्रो. सीवी भास्करन, डा. आर. के. के. पांडेय, प्रो. गोविन्द सिंह, प्रो. पीडी पंत, प्रो. एचपी शुक्ल आदि मौजूद रहे।

‘एव्यू’ सॉफ्टवेयर से होगी पढ़ाई:

हल्द्वानी। एमबीपीजी कॉलेज में आयोजित कार्यशाला में उच्च शिक्षा मंत्री डॉ. इंदिरा हृदयेश ने ‘एव्यू’ सॉफ्टवेयर का उद्घाटन किया। दस सॉफ्टवेयर की लाग

इंदिरा बोलीं, एक-दो दिन में होगा मंत्रिमंडल विस्तार

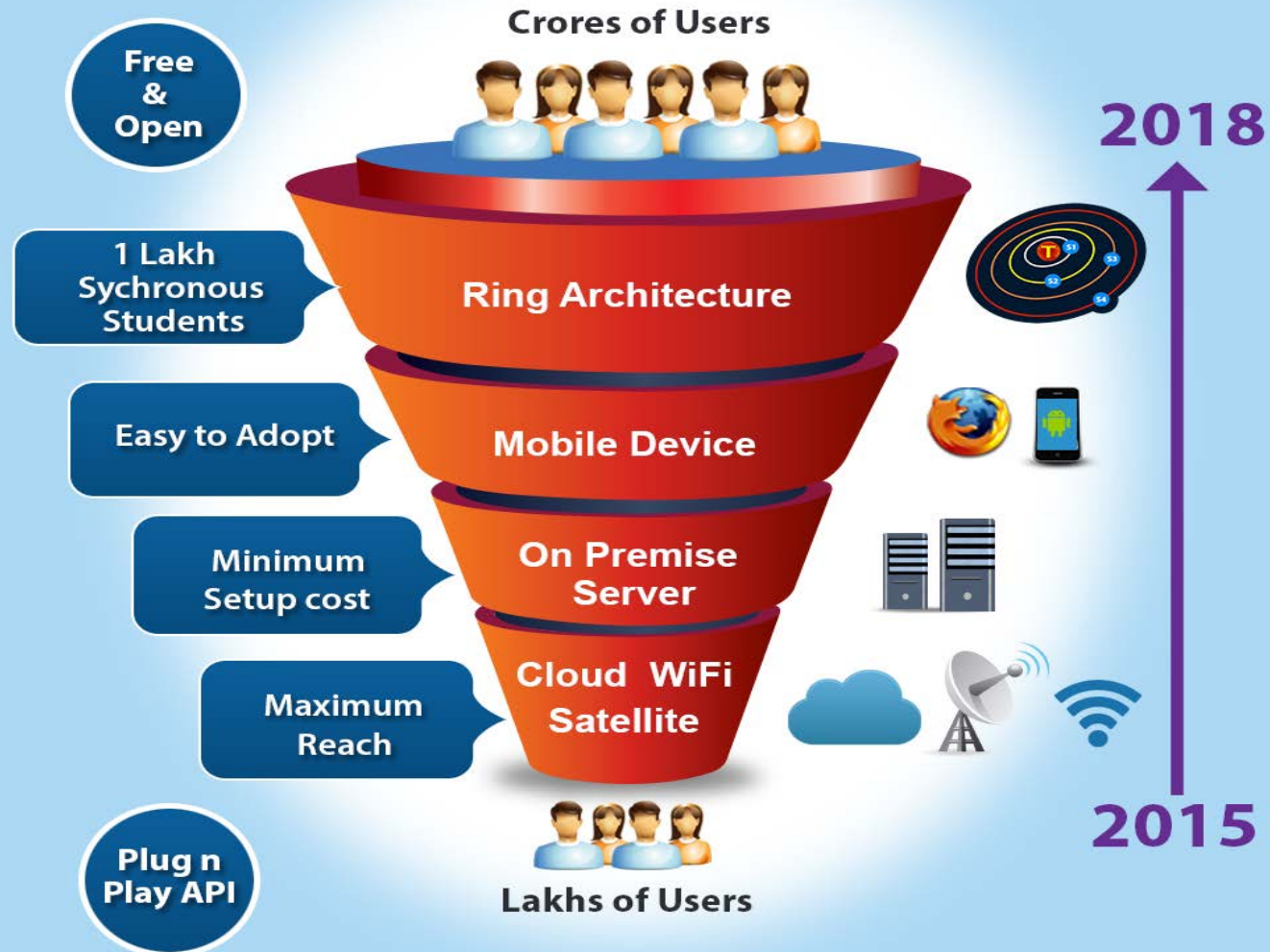
हल्द्वानी। वित्त मंत्री डॉ. इंदिरा हृदयेश ने कहा कि राज्य मंत्रिमंडल में खाली सीटों को एक-दो दिन में भर लिया जाएगा। उन्होंने कहा कि उत्तराखंड में जीएसटी को प्रभावी ढंग से लागू किया जाएगा। इसके लिए राज्य के अफसरों की टीम ने केंद्रीय वित्तमंत्री अरुण जेटली मुलाकात की है। एमबीपीजी कॉलेज में मंगलवार को आयोजित एक सेमिनार में शिरकत करने पहुंची वित्त मंत्री ने कहा कि राज्य सरकार प्रदेश के विकास के लिए तेजी से काम कर रही है। पिछले छह माह में बेरोजगार युवाओं के लिए रोजगार के अवसर खोले हैं। उच्च शिक्षा विभाग में शिक्षकों की नियुक्ति की जा रही है।

मुंबई की ओर से तैयार किया गया साफ्टवेयर की लाग इन आईडी महाविद्यालयों को दी गई। महाविद्यालय लोग इन आईडी से जो जो आते कॉलेज में

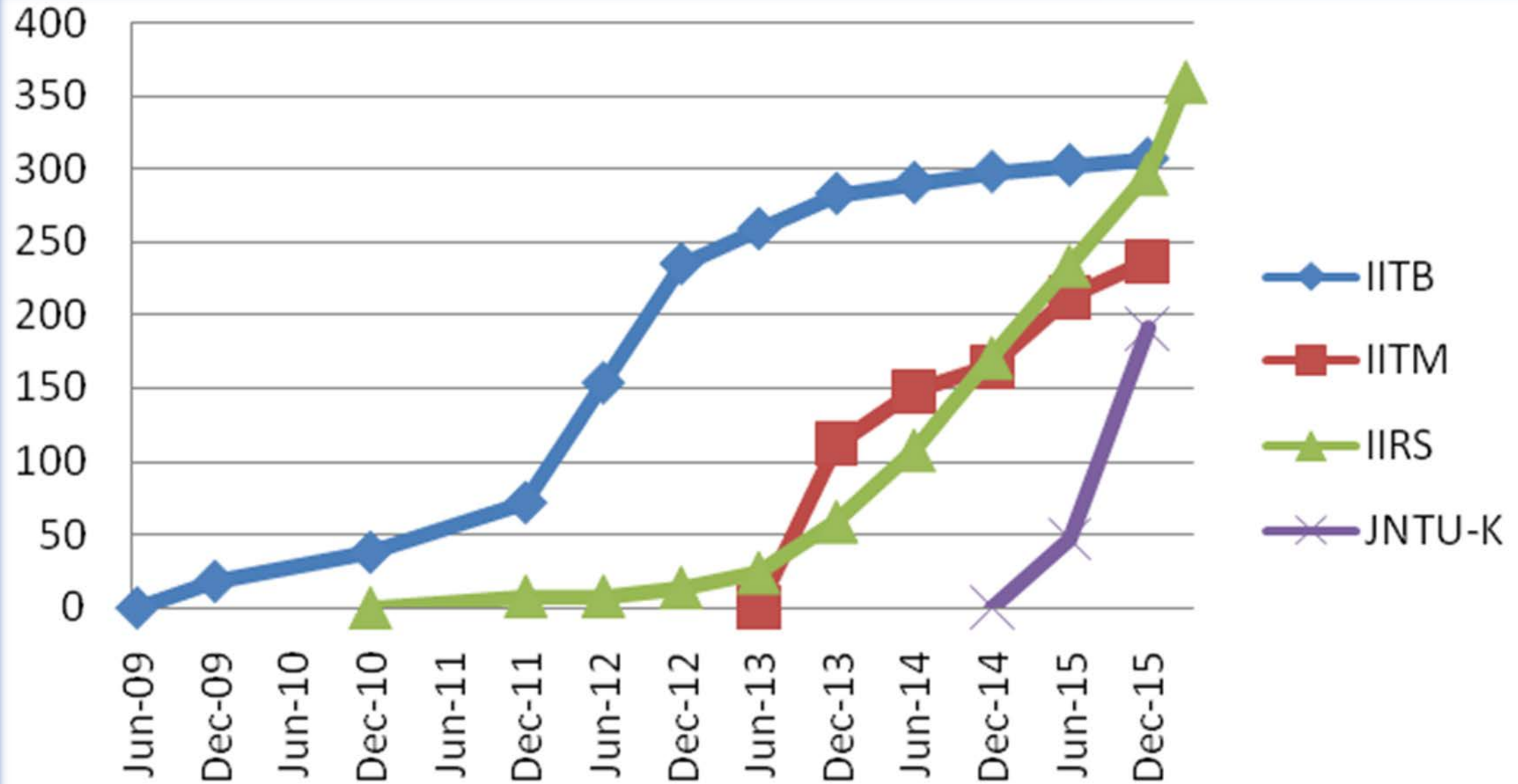
की ओर से तैयार किया गया मेटर्स और यूओयू के ई पोर्टल का उद्घाटन किया। मरम्मत के लिए साढ़े तीन करोड़ मिले।

A-VIEW Phase II

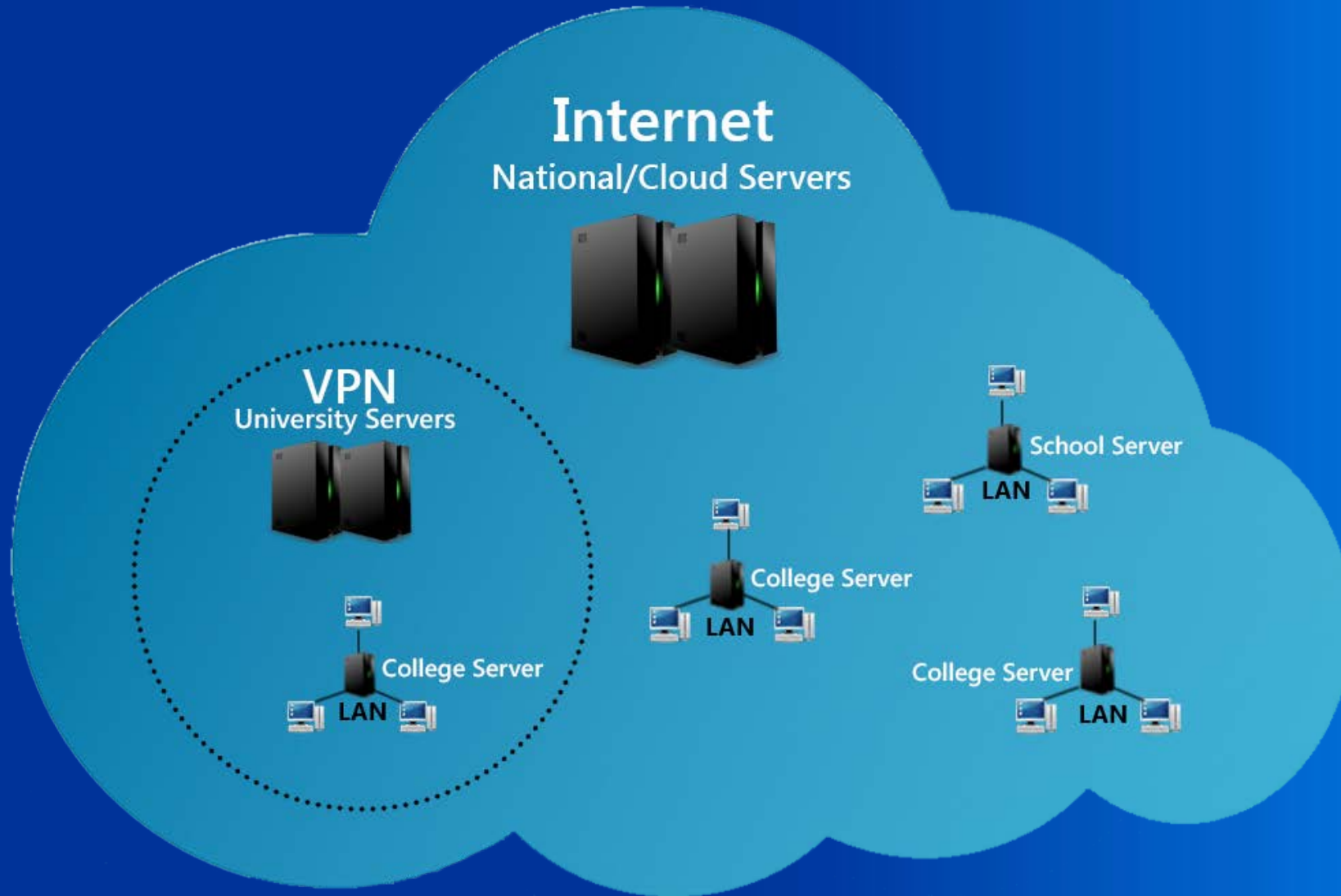
A-VIEW Huge Synchronous Classroom



A-VIEW Remote Centers – Higher Education



A-VIEW Open Server



A-VIEW Free & Open Source with API

- Cloud/National servers – free for everyone; supported by MHRD
 - e.g. Baadal Cloud, Data centers
- VPN servers at Universities
 - Provides better performance
 - e.g. within NKN VPN network
- LAN servers at colleges/schools
 - Provides accessibility to all students; without internet
 - More content security
 - e.g. within any institution campus

Overview

- Single sign-on
- Upload content from other platform
- Get audit data
- Get attendance report
- Synchronize user data
- Synchronize course/class scheduling

A-VIEW Integrated with IITM QEEE

The screenshot displays the A-VIEW web client interface. The browser address bar shows `aview.qeee.in/webclient/aview_sso.php`. The page header includes the A-VIEW logo (Amrita University), MHRD logo (Funded by NME-ICT), and QEEE logo. A navigation bar contains various icons for user management, chat, and content. A welcome message "Welcome karthikac QEEE" is visible in the top right.

The main interface is divided into several sections:

- Users Panel:** A table listing participants with columns for Name, IC, and Status.
- Presenter Video:** A large central video window showing a presenter.
- Thumbnail View:** A smaller video window on the right showing a "Video in BigScreen" and a thumbnail of the presenter.
- Status Bar:** A bottom bar indicating "Collaboration connected. Video connected. Course : QEEE-II Lecture : Session 3".

Name (Count 25)	IC	Status
M: Ashwin Mahalingam QEEE	0	
P: itm_studio1 Studio1 QEEE	0	
V: TCE_TCEChitra Dr.G.Ci QEEE	1	
ITM Presenter QEEE	0	
AJTMAP_aitam AJTAM QEEE	0	
Amrita Rec Amrita E-Learning Research L	0	
AMRITATN_amritacbe Am QEEE	1	
AVIEW Recording Amrita E-Learning Research L	0	

Collaboration connected. Video connected. Course : QEEE-II Lecture : Session 3

A-VIEW (Amrita Virtual Interactive E-Learning World) Version 3.7.13496- © 2007-2014

SWAYAM A-VIEW Integration



MHRD | Government of India
Ministry of Human Resource Development



All India Council for Technical Education

REGISTER

LOGIN

ENGLISH



"Beta"

HOME ABOUT SWAYAM COURSES FACULTY INSTITUTIONS



NO AGE. NO
BOUNDARIES. NOW
NO MORE
LIMITATIONS.

Learning made easy with SWAYAM,
An MHRD initiative



DISCOVER YOUR LEARNING PATH

SCHOOL ^

Not finished school yet?

[Do it here](#)

CERTIFICATE v

DIPLOMA v

UNDERGRADUATE v

POSTGRADUATE v



SWAYAM A-VIEW Mobile App

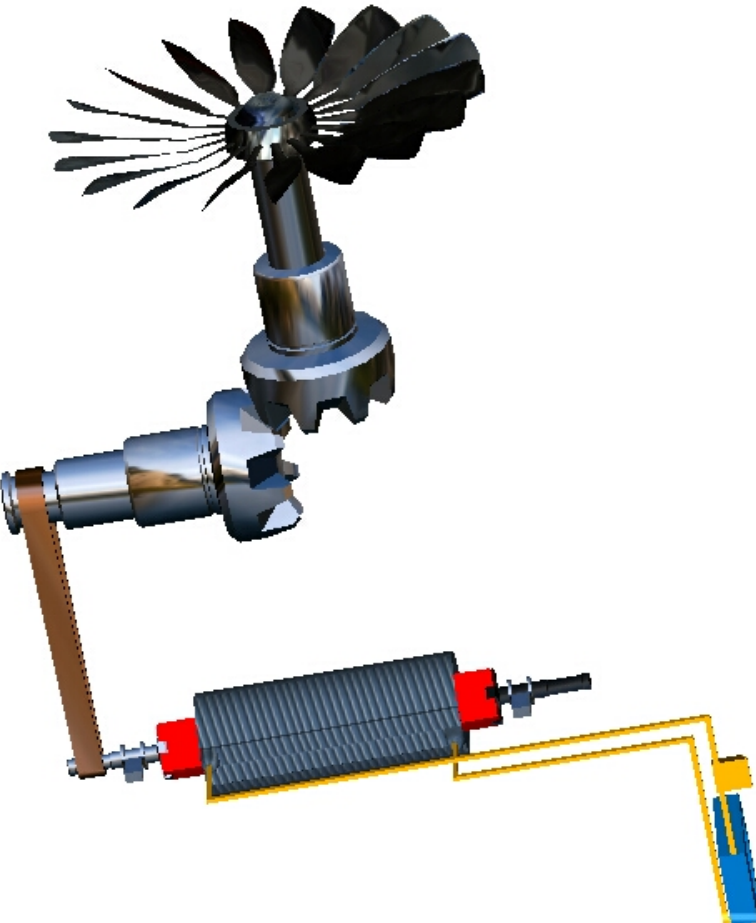
airtel

AMRITA UNIVERSITY

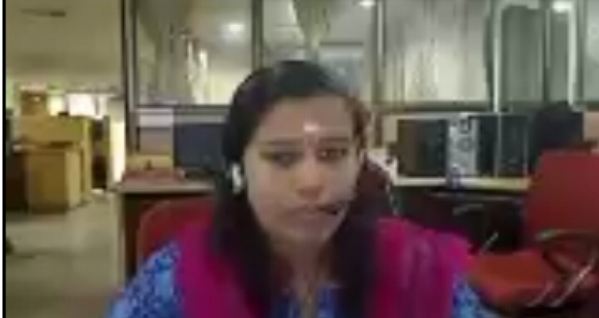
Handraise Start Video Post Question Rejoin Video

10:48 AM

Gear 001



P : Prof Kamal Bijlani(Video)



Chat

Hello

15

SWAYAM Integration

- Architecture Discussions with Microsoft under-way
- Roadmap Overview
 - Single Sign-On
 - Live Doubt Clearance Sessions
 - Live Classroom Monitoring
 - Teacher Self-Recording of Lectures
 - Seamless Web Integration

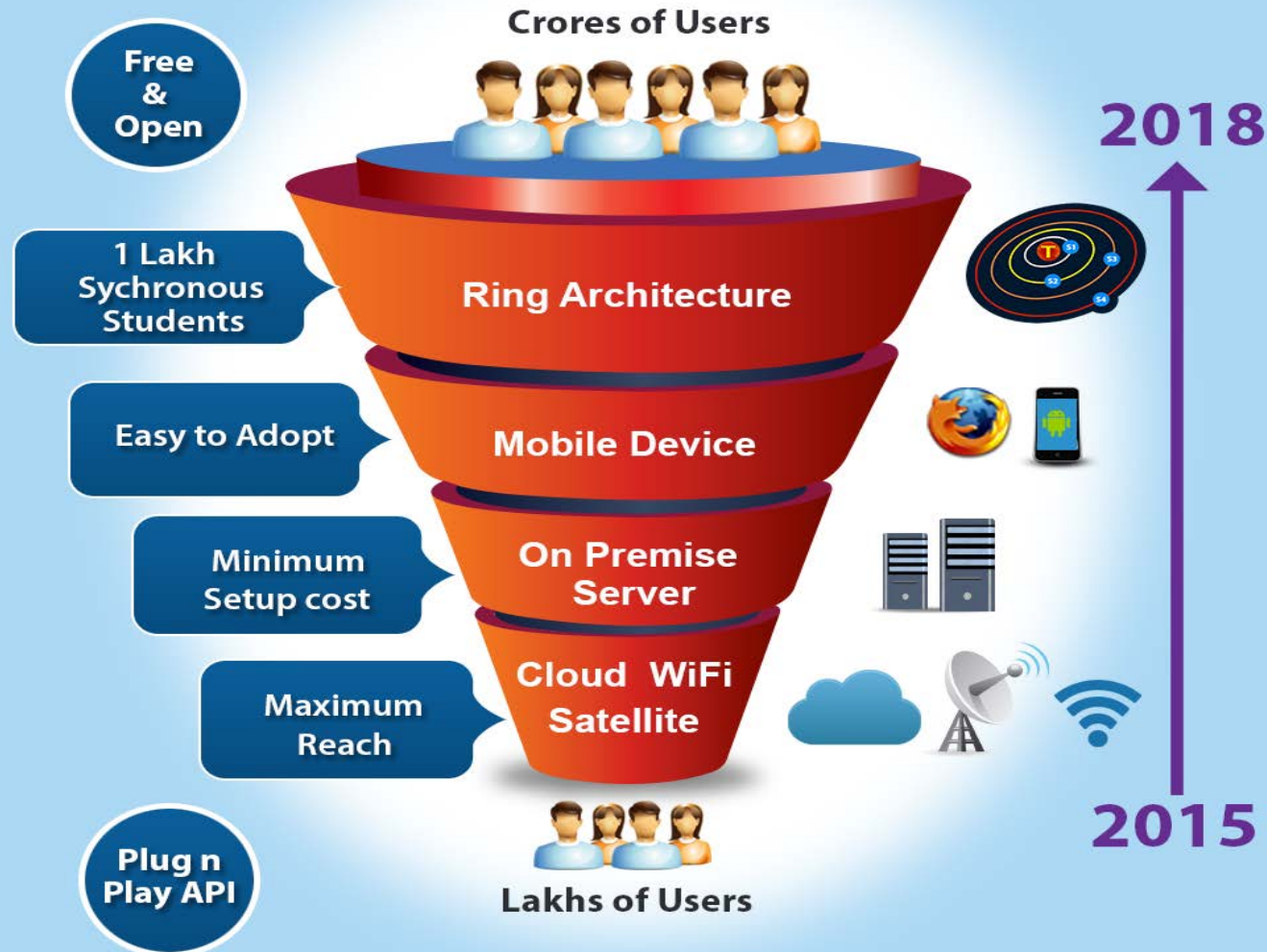
A-VIEW on ISRO Satellite Network

- Remote Areas
- Testing ongoing with ISRO Dehradun & Ahmedabad



A-VIEW Phase II

A-VIEW Huge Synchronous Classroom



A-VIEW Maintenance

- Continue A-VIEW Support for Major Stakeholders
- Complete partial features requested by Customers
 - FOSS for institutions using it locally on their own
 - Mobile App (70% completed)
 - Satellite (80% completed)
- Scale A-VIEW Deployment to Crores of users

A-VIEW Interoperability

- Requested by DEC Connectivity (HRD Ministry)
 - Interoperate with MCU's and other Video Conferencing Equipment
 - Integrate with Campus Wi-Fi initiative
- Increase Wi-Fi/Internet utilization
- Mobile A-VIEW adoption on Campus Wi-Fi

Phase II – Modules

M1: Huge Virtual
Synchronous
Classrooms

M2: Classroom
Monitoring & Attention
Analysis

M3: Adaptive Plug and
Play Devices

M4: Open Source
Server Components

M5: Major Requests
From Stakeholders

M6: Synchronous
Tutoring Groups

M7: A-VIEW Using Low
End Mobiles

M8: Local Synchronous
Producer And Player

M9: Automation Testing
& System Integration

M10: Implementation
For One Crore Users

M1: Huge Virtual Synchronous Classrooms



User Interface for each Role Type



Teacher
Content



Teaching Assistant
Content, Forum, Interaction



System Admin
Troubleshooting



Monitor
Supervision, Analytics



Live Classroom Monitoring

Computer Networks : Screenshots Date : 2014-07-04

Unable to see thumbnail view? [Click here to see list view of the screenshots](#)

RC ID : 1001



RC ID : 1002



RC ID : 1003



RC ID : 1005



RC ID : 1007



RC ID : 1008



RC ID : 1011



RC ID : 1013



RC ID : 1014



RC ID : 1015



RC ID : 1016



RC ID : 1019



RC ID : 1020



RC ID : 1022



RC ID : 1024



M2: Classroom Monitoring and Attention Analysis

The screenshot displays the 'A-VIEW II' University Control Panel interface. The top navigation bar includes the title 'A-VIEW II', the subtitle 'University Control Panel', and links for 'Monitoring | Plugins | Users'. The status bar shows 'BELL' as the carrier, the time '4:21 PM', and a 100% battery level. A user profile for 'IITB Monitor 1' is visible in the top right corner.

The main content area is titled 'Classroom Monitoring' and features six video thumbnails of classrooms, each with a student count overlay at the bottom:

- Top-left: 50 Students
- Top-middle: 75 Students
- Top-right: 20 Students
- Bottom-left: 48 Students
- Bottom-middle: 15 Students
- Bottom-right: 45 Students

To the right of the thumbnails is a vertical list of names, with some names highlighted in blue:

- Arun Krishnan
- Veena
- Vijayakumar
- Sunil Kumar
- Naveen Narayan
- Prasanth M
- Athi Narayanan
- Ashish
- Hareesh
- krishnakumar
- Neema
- Abhirami
- Sethu
- Dharmik Dev
- Swathik
- Thumbi

M3 : Adaptive Plug and Play Devices

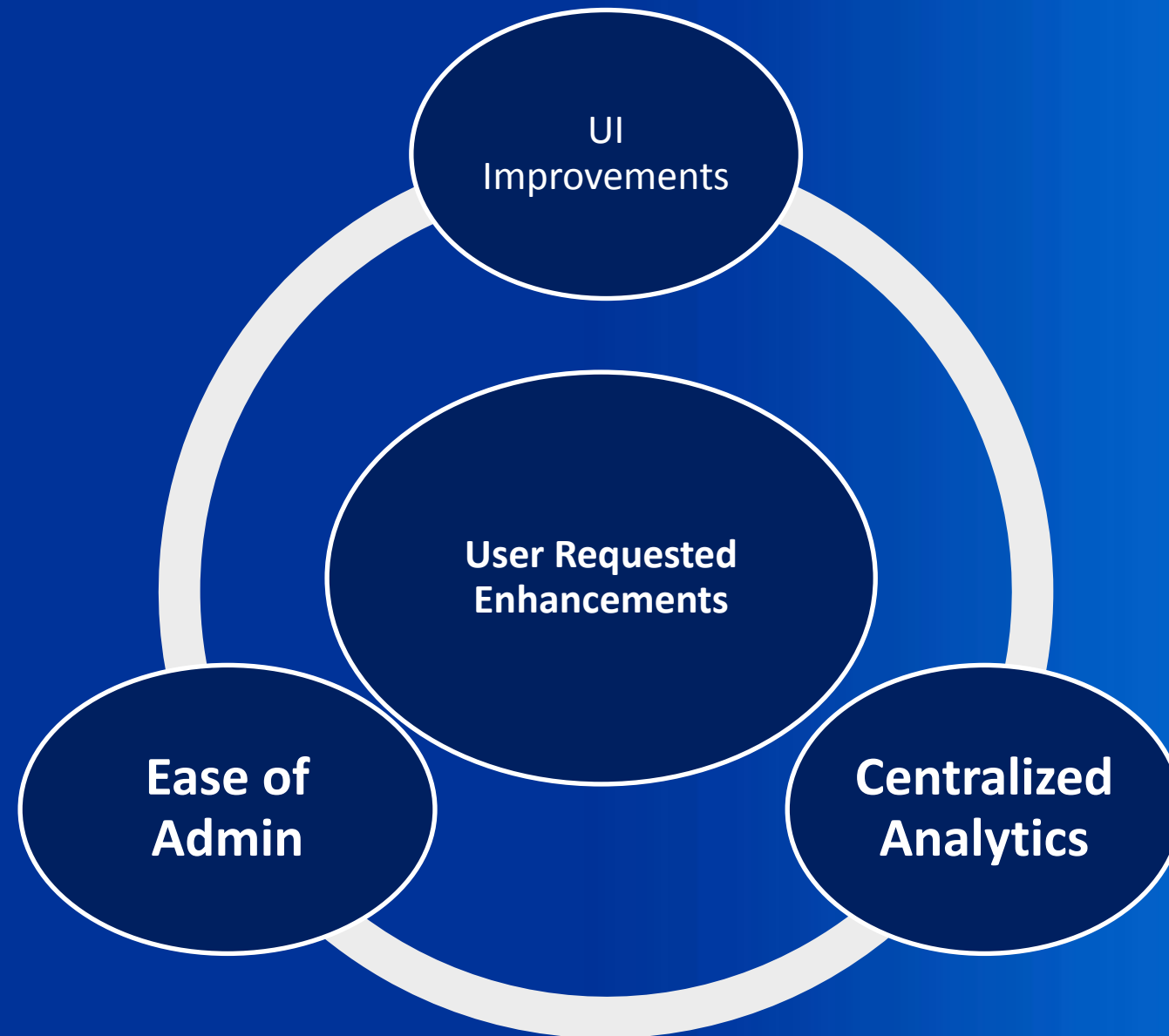
Summary: Plug and Play Devices

Support for wide-variety of certified audio and video devices.

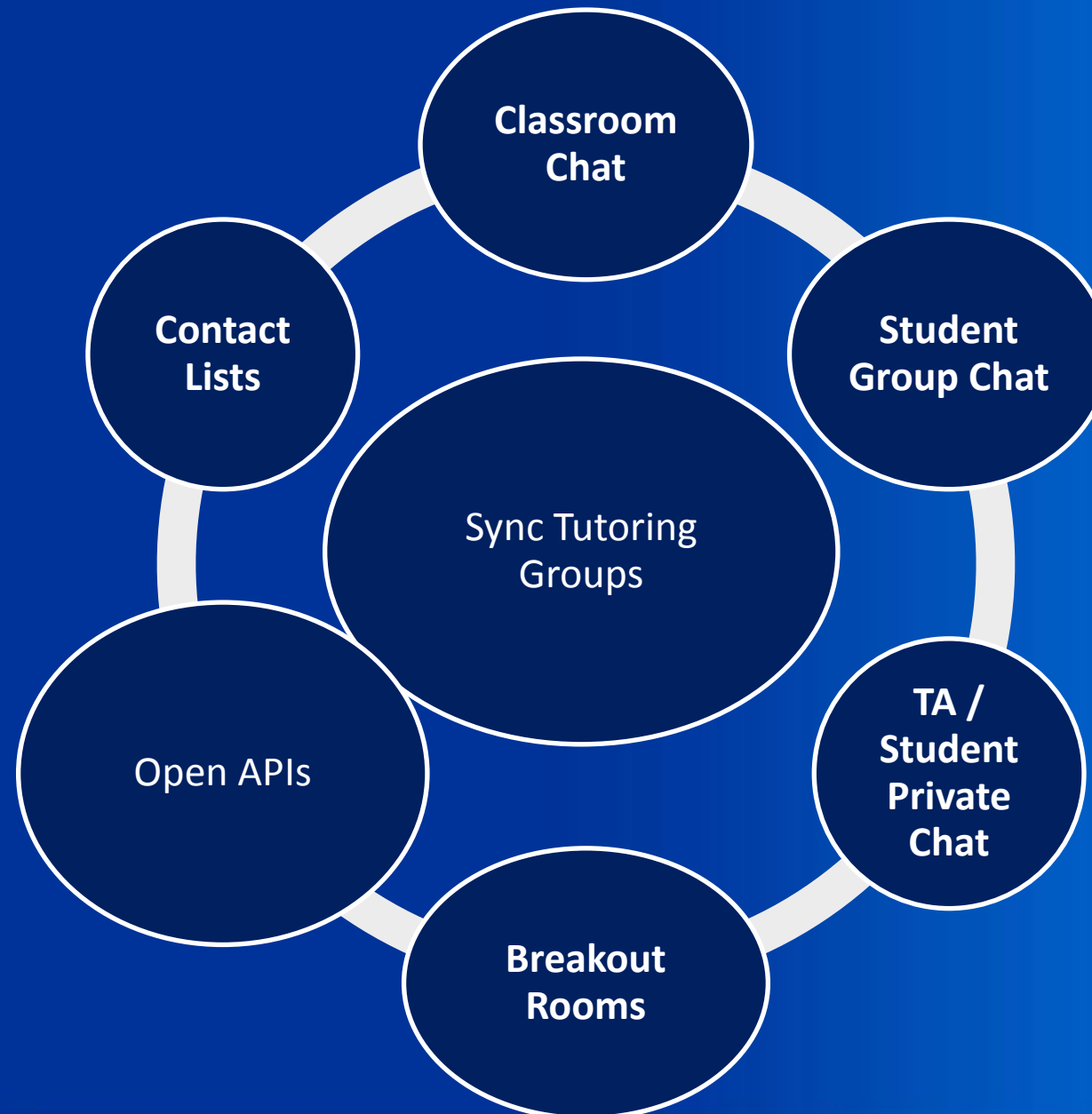
Overview:

- Automatic Device Recognition
- Seamless reconfiguration
- Cloud-based Profiles and Roaming
- Device Certification
- Quality Lab

M5: Major Requests From Stakeholders



M6: Synchronous Tutoring Groups



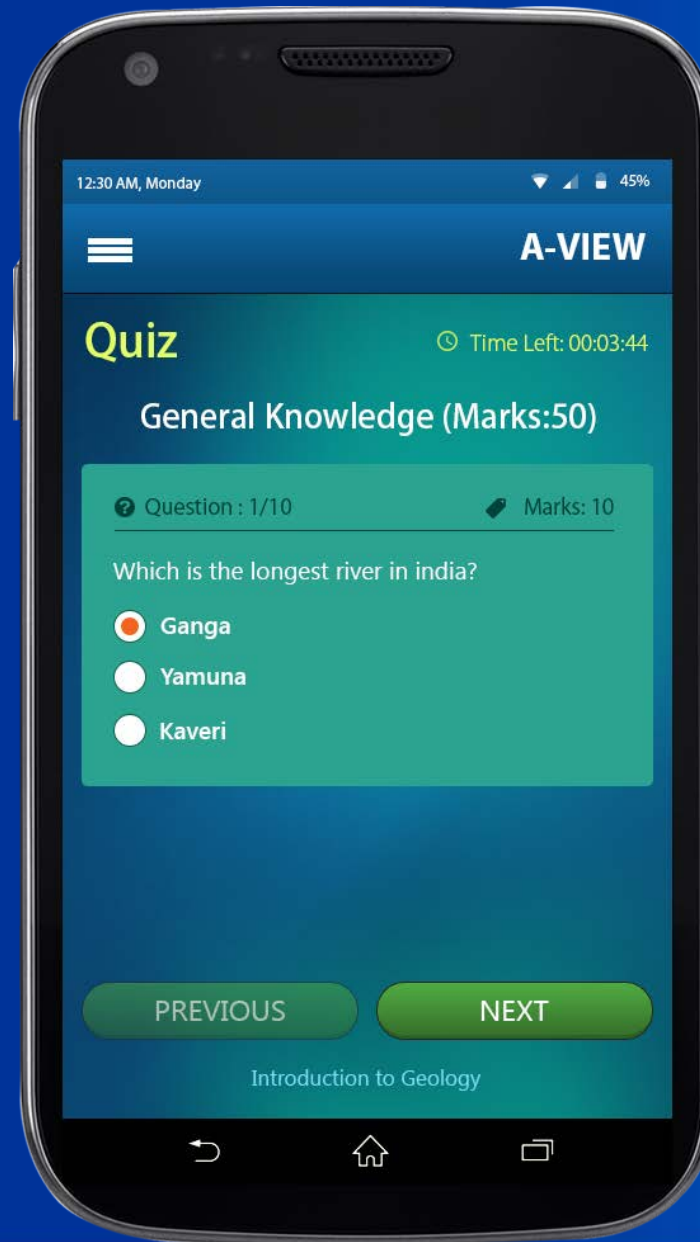
A-VIEW On Mobile



Immediate Feedback Mechanism



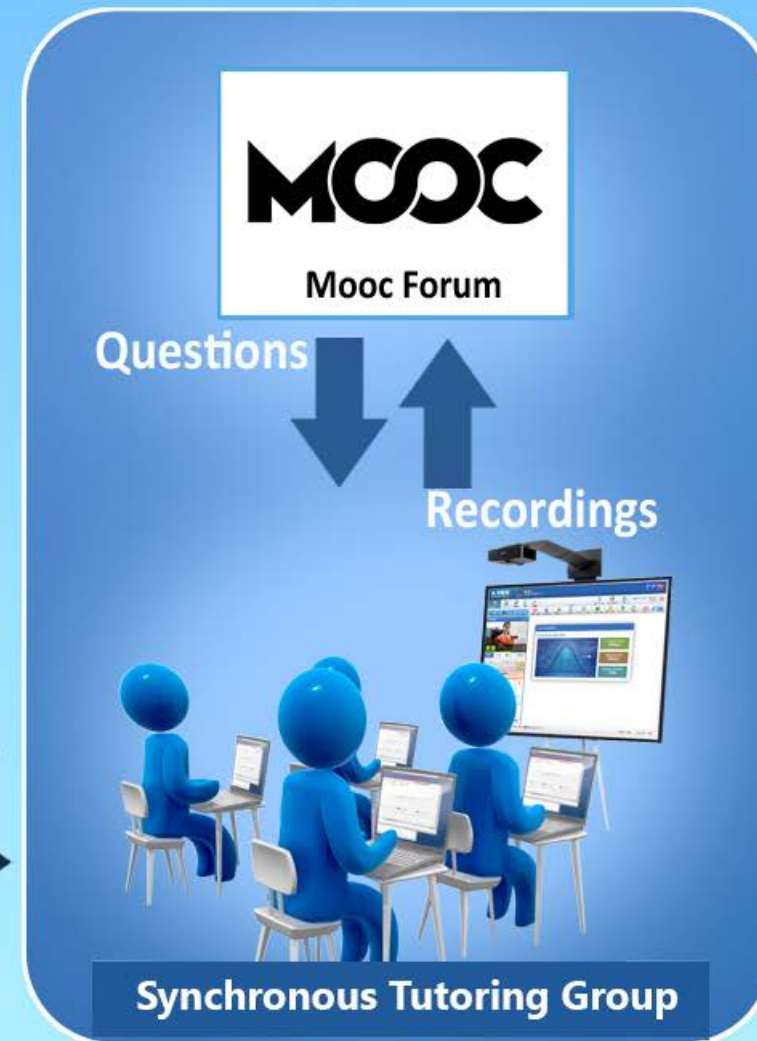
Live Mobile Quiz



Live Poll



Blended Doubt Clearance



M9: Automation Testing & System Integration

- Automation Testing
 - Server / Cloud Validation
 - Client Automation
 - Load Testing
 - Satellite
 - IP Multicast
- Tools for Deployment Validation
 - Private Cloud Deployments
 - Self-Check Tools for Admins

M10: Implementation for 1 Crore Users

- **Deploy to 1 Crore Learners and Teachers**
 - Divide the Country into Regions
 - Regional Phased Deployments
 - Bi-Annual Managed Refresh
- **Regional Support Coordinator**
 - Regional Implementation Plan
 - Dedicated Trainings in Selected Cities
 - Minimize Travel Budget for Admins

Implementation for 1 Crore Users

- **Central Deployment Team**

- Assisted Remote Deployments
- Regular Online Trainings

- **24x7 Technical Support**

- Phone / Chat / Email Support
- Prioritized Ticketing System

- **24x7 IT Support**

- On-Call System Admins
- Network Alerting, Escalation

Implementation for 1 Crore Users

- **Training & Documentation**
 - A-VIEW II Setup & Management
 - A-VIEW II – Configuring and Managing Users
 - A-VIEW II User Guide
 - Videos showing how to use A-VIEW II
 - Mobile App User Guide
 - Videos showing how to use the Mobile App
 - Multi-Language Documentation
 - Multi-Language Trainings

A-VIEW 5.0 Features

Client:

Mobile & Tablet

Easy MP4 Recording

Self-Recording Producer

Audio-Video

System/Server:

Open Source A-VIEW

License-Free National A-VIEW Server

Red 5 Server

Internet & Satellite

Phase 1 – Funding Summary

A-VIEW Phase I Funds (Received)					
A-VIEW Phase I Summary (in Lakhs)					
Oct 2010 - Sept 2015					
Grants Sanctioned		3,446.80			
Grants Received		3,445.70			
No.	Financial Year	Amount	Team Size	Institutions using A-VIEW	Comments
	Phase I				
1	2010-11	1034	100	20	Main Project Started
2	2011-12	200	140	127	
3	2012-13	593.7	160	693	
4	2013-14	768	165	2,762	
6	2014-15	400	150	4,207	Funds exhausted in September 2014
7	2015-16	0	120	8,426	No funds received in 2015; 5 crore Advance from Amrita Universtiy;
8	2016-17	450	74	10,141	450 Lakhs received, paid back to Amrita Univ.
	Total Phase I	3446			

Phase II – Original Total Budget

#	Line Items	Amount (in la
A	Total original budget	1484.47
	A = B + C	
B	Budget for Maintenance Items	1179.92
C	Budget for New features	304.55
	C = D + E (Swayam Breakup)	
D	New Features (some overlap with Swayam)	49.23
E	New Features (not part of Swayam)	255.32
	New Requirement (Module 11)	
F	A-VIEW Interoperability*	179.61

Maintenance Budget	1179.92
New Modules not overlapping with Swayam	255.32
New Module: A-VIEW MCU Inter-Operability *	179.61
Revised Total Budget (in lakhs)	1614.85

Deliverable Breakdown by Module

Item	Module Name	Maintenance Items	New Features	Total To-Do Items
Module 1	Huge Virtual Synchronous Classrooms	23	9	32
Module 2	Classroom Monitoring and Attention Analysis	30	15	45
Module 3	Adaptive Plug and Play Devices	35	7	42
Module 4	Open Source Server Components	17	5	22
Module 5	Major Requests from Stakeholders	41	12	53
Module 6	Synchronous Tutoring Groups	16	10	26
Module 7	A-VIEW using Low End Mobiles	11	7	18
Module 8	Local Synchronous Producer and Player	11	8	19
Module 9	Automation Testing and System Integration	100%		
Module 10	Implementation of A-VIEW for Crores of Users	100%		
		184	73	257
41		Maintenance	New	Total

Budget Breakdown by Module

Module #	Functional Description	Total Budget	Total No. of Items	# of Maintenance Items	Maintenance Budget	# of New Features Items	New Features Budget
Module 1	Huge Virtual Synchronous Classrooms	169.98	32	23	122.17	9	47.81
Module 2	Classroom Monitoring and Attention Analysis	130.40	45	30	86.93	15	43.47
Module 3	Adaptive Plug and Play Devices	99.74	42	35	83.12	7	16.62
Module 4	Open Source Server Components	97.48	22	17	75.33	5	22.15
Module 5	Major Requests from Stakeholders	158.45	53	41	122.57	12	35.88
Module 6	Synchronous Tutoring Groups	129.95	26	16	79.97	10	49.98
Module 7	A-VIEW using Low End Mobiles	143.31	18	11	87.58	7	55.73
Module 8	Local Synchronous Producer and Player	78.17	19	11	45.25	8	32.91
Module 9	Automation Testing and System Integration	138.05	100%	100%	138.05		
Module 10	Implementation of A-VIEW for Crores of Users	338.95	100%	100%	338.95		
		1484.47	257	184	1179.92	73	304.55

Phase II - Maintenance Budget

Expense Head	Y1	Y2	Y3	Total (3 yr)
Total In Lakhs				1179.81
Non Recurring	Y1	Y2	Y3	1039.22
Equipment	81.22	47.90	0.00	129.12
Total Salary	325.45	285.67	298.98	910.10
	406.67	333.57	298.98	
Recurring	Y1	Y2	Y3	140.59
Contingency	3.42	6.20	7.58	17.20
Consumables & Supplies	3.34	6.02	7.34	16.70
Internet for Servers & Development	3.10	7.45	9.11	19.66
Mobile & Internet	4.44	9.36	11.33	25.13
Regional Support & Training	6.5	15.3	18.7	40.5
Travel & Stay	4.8	7.4	9.2	21.4
	25.60	51.73	63.26	
Total (Rec + Non Rec)	432.27	385.30	362.24	

Thank you

- Thank you

Appendix

Year 1 Expenditure

A-VIEW Maintenance Budget: Oct 2015 - Sept 2016			Total: 432.27 Lakhs
Expenses (in Lakhs)	Incurred / Committed Oct 2015 - June 2016	Next 3 Months July 2016- Sept 2016	Comments & Explanation
Staff Salary	248.73	76.72	Incurred Expenses; Salary for 3 months
Hardware: A-VIEW Load Testing, Implementation	58.29	20.9	Hardware: A-VIEW Load testing for simultaneous large number of users
Hardware Maintenance	1.5	0.53	Minor Hardware maintenance
Consumables and Contingencies	16.5	4.3	Bandwidth costs for A-VIEW test servers; Data Cards; Other Support costs
Travel & Implementation Expenses	3.6	1.2	Travel and expenses for implementation engineers
Total	328.62	103.65	432.27

Year 1 Hardware (Non-Recurring)

A-VIEW Testing Hardware	Count	Unit Cost in Lakhs	Completed in Lakhs	Pending
Video Conf Equip for testing - Student grade	10	0.10	1.0	
Projector (for testing)	4	0.60	2.4	
Video Conf Equip for testing - Classroom grade	10	0.25	2.5	
30 TB NAS Desktop Storage (Lacie)	2	3.50		7.0
High end Machine for /Teting/Server	2	1.20	2.4	
Mobile for Implementation - Category 5	8	0.20		1.6
Support Laptops - Category 1	6	0.40	2.4	
Workstations For Implementation	14	0.45		6.3
Video Streaming Server (Development and Test)	2	3.00		6.0
SAN Server (10 TB Storage Capacity)	1	6.00	6.0	
Software for Server, Computers	2	2.00	4.0	
Displays - TVs/Monitors	3	0.60	1.8	
Laptops For Testing - Category 2	4	0.65	2.6	
Workstations For Test / Dev	32	0.72	23.0	
Mobiles - Category 1 (for testing)	6	0.08	0.5	
Mobiles - Category 2 (for testing)	9	0.15	1.4	
Mobiles - Category 3 (for testing)	9	0.2	1.8	
Mobiles - Category 4 (for testing)	6	0.3	1.8	
Tablets - Category 1 (for Testing)	4	0.1	0.4	
Tablets - Category 2 (for Testing)	4	0.3	1.2	
Tablets - Category 3 (for Testing)	4	0.48	1.9	
Handy Cam - for testing	3	0.4	1.2	
Total			58.29	20.90

Year 2 Hardware (Non-Recurring)

A-VIEW Testing Hardware	Count	Unit Cost in Lakh	Pending
30 TB NAS Desktop Storage (Lacie)	1	3.50	3.5
High end Machine for /Teting/Server	2	1.20	2.4
Workstations For Implementation	6	0.45	2.7
Video Streaming Server (Development and Test)	1	3.00	3.00
Software for Server, Computers	4	2.00	8.0
Displays - TVs/Monitors	4	0.60	2.4
Laptops For Testing - Category 2	10	0.65	6.5
Workstations For Test / Dev	27	0.72	19.4
			47.94

Module Teams Breakdown

#	Item	Module Name	Team
1	Module 1	Huge Virtual Synchronous Classrooms	6
2	Module 2	Classroom Monitoring and Attention Analysis	4
3	Module 3	Adaptive Plug and Play Devices	6
4	Module 4	Open Source Server Components	6
5	Module 5	Major Requests from Stakeholders	5
6	Module 6	Synchronous Tutoring Groups	4
7	Module 7	A-VIEW using Low End Mobiles	6
8	Module 8	Local Synchronous Producer and Player	4
9	Module 9	Automation Testing and System Integration	7
10	Module 10	Implementation of A-VIEW for Crores of Users	26
			74

Implementation Team - Breakdown

Sl.No	Item	Qty
1	Deployment Manager	1
2	Regional Support	8
3	Trainers	3
4	Support Staff	3
5	Helpdesk Analyst	4
6	Technical Analyst	2
7	System Admin (24 Hour Service)	5

A-VIEW 5.0/5.1 Deliverables

Row Labels	Sum of 5.x
Adaptive Plug & Play Video	5
A-VIEW using Low-End Mobiles	8
Classroom Monitoring & Attention Analysis	6
Huge Virtual Synchronous Classrooms	6
Local Synchronous Producer & Player	6
Major Requests from Stakeholders	7
Open Source Server Components	3
Synchronous Tutoring Groups	2
Grand Total	43

A-VIEW 5.0/5.1 Summary

Module	5.0/5.1 Features Committed
Adaptive Plug & Play Video	Improved Pre-testing, Network Self-Testing, Automatic Mixer/Local Echo Detection
A-VIEW using Low-End Mobiles	HTML5 Client – Poll, Quiz, User List
Classroom Monitoring & Attention Analysis	Dedicated Monitoring Role, Functionality for Monitors
Huge Virtual Synchronous Classrooms	A-VIEW on Satellite, Multicast
Local Synchronous Producer & Player	MP4 Recording, Local Recorder
Major Requests from Stakeholders	Analytics & UI improvements
Open Source Server Components	Open Content Server, Bulk Admin Activities

A-VIEW Interop Module Budget

A-VIEW Interop with MCUs				
Sl.No	Item	Year 1	Year 2	Year 3
Non Recurring Cost				
1	Equipment	49.30	0.00	0.00
2	Module Dev Salary	36.00	39.60	43.56
	TOTAL (Non Recurring Cost)	85.30	39.60	43.56
Recurring Cost				
1	Contingency	0.60	0.70	0.80
2	Consumables & Supplies	0.60	0.70	0.80
3	Internet for Servers & Development	0.50	0.75	1.00
4	Mobile & Internet	0.50	0.75	1.00
5	Travel & Stay	0.80	1.00	1.20
	TOTAL (Recurring Cost)	3.00	3.90	4.80
	Total (Non Recurring + Recurring)	88.30	43.50	48.36
		Grand Total (Lakhs of Rs)		180.16
Module Dev Fees and Module Support , Maintenance Details				
Sl.No	Item	Qty	Rate (in Lakhs)	Budget (in Lakh)
1	Sr. Technical Manager	1	8.4	8.4
2	Lead Software Engineer	2	6.6	13.2
3	Software Engineer	2	4.8	9.6
4	Jr Test Engineer	2	2.4	4.8
		7	Total (Lakhs of Rs)	36
Equipment (In lakhs)				
Sl.No	Item	Qty	Rate (in Lakhs)	Budget (in Lakh)
1	Server Machine for development/testing	2	1.3	2.6
2	Workstations (for Development, Server)	5	0.75	3.75
3	Laptops (for Testing) Category 2	3	0.65	1.95
4	Polycom MCU Testing Equipment	3	7	21
5	Displays - TVs/Monitors	5	0.6	3
6	Polycom HDX 7000	2	8	16
7	Polycom RealPresence Software	5	0.2	1
			Total (Lakhs of Rs)	49.3

Current Status – Year 1 Completed

- Year 1 expense of Rs. 432. 27 Lakhs
 - On-Loan from Amrita University since Sep 2015
 - Pending salary Arrears of Rs. 35 Lakhs
 - Many senior staff on voluntary moratorium on salary raises / partial salaries – Rs. 23.58 Lakhs

Current Status – Year 1

- Worked on Year 1 Deliverables since Oct 2015
- Version 5.0 to be released soon
- 5.0 Beta Given to IIT Bombay – Working on feedback
- 5.0 Beta running on Production Server for QEEE

Program @ IIT Madras



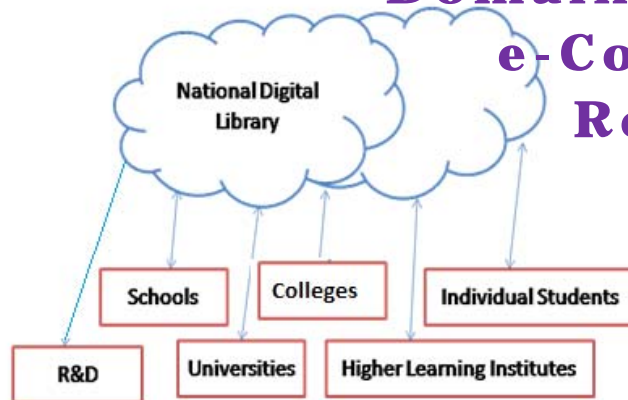
Development of National Digital Library of India

Towards Building a National Asset



A PILOT PROJECT

Project Brief: 07-SEP-2016
Domain Expert Committee on
e-Content, Pedagogy &
Related Activities



Presented by

Prof. PARTHA PRATIM DAS

ppd@cse.iitkgp.ernet.in

Joint PI, NDL Project, NME-ICT, MHRD
Indian Institute of Technology, Kharagpur



Agenda

2

- **Scope, Status & Progress**
- **HRM Review**
- **PRSG Review**
- **Fund Requirements**



Scope

3



NDL – A Pilot Project: Scope



4

- NDL is a pilot project of 3-year duration
- Start: April, 2015
- Scope of the pilot project
 - Creation of a 24X7-enabled Infrastructure suitable for 10,000 Concurrent Users
 - Harvesting IDR (Institutional Digital Repository) of 100 Contributing Institutes
 - Integrate contents from eLearning repositories like INFLIBNET, NPTEL, NCERT, DLI, NMEICT projects
 - Participatory adoption by 100 Participating Institutes
 - Host 1000 LMS Courseware



Status & Progress

5

PORTAL
CONTENT SOURCES
CONTENT PIPELINE
METADATA STANDARD
SYSTEM STATUS
AWARENESS DRIVE & EVENTS
USER REGISTRATION & POPULARIZATION



Portal Status



6

- NDL Portal (<https://ndl.iitkgp.ac.in>) gone live in Feb'16
 - 24X7 infrastructure
 - ✦ Partial server capacity (about 30% of planned)
 - ✦ Partial access bandwidth (about 50% of planned)
 - English and Vernacular (Hindi & Bengali) User Interface
 - 15 lakh+ content
 - 70 Harvested IDRs from Contributing Institutes
 - Contents of INFLIBNET, NPTEL, NCERT, DLI, a few NMEICT projects, Librivox (Audio Books), OECD, IIT-JEE Question Papers & Answers & Satyajit Ray Redbook archive
 - Contents of couple of international publishers
 - Got users from about 325 Participating Institutes registered

- Portal Screenshots





Content Pipeline



7

- Another 6 IDRs harvested and ready to go Live
- Karnataka Board Text Books, Question Papers, Solutions, Teachers' Manual ready to go Live
- Joint Admission Test for M.Sc. (JAM) Question Papers (10 years) ready to go Live
- South Asia Archive ready to go Live
- World e-Book Library (WeL) (about 50%: 20 lakh) ready to go Live
- IEEE Publications (about 25%: 9 lakh) ready to go Live
- PubMed Publications (about 25%: 7 lakh) ready to go Live



Metadata Standard



8

- Ver-1 of NDL Metadata Schema Manual published (www.ndlproject.iitkgp.ac.in/)



Systems Status

9

- 2nd lot of servers received and installation and setup configuration are in advanced stage
- **Disaster Recovery system**
 - Server Room Infrastructure (A/C, UPS, Fire Alarm & Protection, Security Surveillance, Server Racks) Tender Evaluation completed and Order is being placed
 - Server sizing and tender document preparation started
 - Access bandwidth request initiated
- Sizing and tender document preparation for 3rd lot of servers initiated



Awareness Drive & Events



10

- 8 Workshops on NDL familiarization and IDR setup conducted across the country
- Contributing & Participating Institute support
 - Hand-holding Contributing Institutes to set up IDR and making IDR harvestable
 - Hand-holding users of Participating Institutes
 - ✦ Registration
 - ✦ Usage
 - ✦ Query response



Awareness Drive & Events



11

- Workshop @ INDEST Meet @ Mohali, 29/30-Apr-15
- National IDR WS @ IIT Kharagpur, 15/17-June-15
- Regional (North-East-I) IDR WS @ IIT Guwahati, 04/05-July-15
- National Seminar on “Emerging Trends in Academic Libraries” @ IIT Kharagpur, 21-Aug-15
- Regional (North-I) IDR WS @ IIT Roorkee, 24/25-Aug-15
- ETD 2015 India @ JNU New Delhi, 05/06-Nov-15
- 4th NKN Annual WS @ JNTU Hyderabad, 21/22-Jan-16
- Regional (West-I) IDR WS @ M S University, 28/29-Jan-16
- National VC Address over NKN, 03-Feb-16
- Regional (South-I) IDR WS @ IIT Madras, 25/26-Mar-16
- Regional (South-II) IDR WS @ IISc, Bangalore, 20/21-May-16
- National Workshop for Open-Source Software for Library Management (OSSLM 2016) @ IIT Kharagpur, 13/18-Jun-16
- Regional (South-III) IDR WS @ IIIT, Hyderabad, 01/02-Jul-16
- Regional (North-II) IDR WS @ JNU, New Delhi, 01/02-Sep-16
- **Regional (North East-II) IDR WS @ NIT Meghalaya, Shillong 23/24-Sep-16**
- **Regional (West-II) IDR WS @ IISER Pune, 05/06-Oct-16**
- **National (Medical) IDR WS @ AIIMS New Delhi, 20/21-Oct-16**
- **Regional (Central-I) IDR WS @ NIT Raipur, 18/19-Nov-16**
- **National (Law) IDR WS @ WB-NUJS Kolkata, 09/10-Dec-16**



User Registration

12

- **Registered Users: 2.45 Lakh**
- **Active Users: 70K**
- **Controlled registration to ensure**
 - Gradual build up of load on the system
 - Security issues, if any, gets addressed with a smaller user base
 - Limited to CFTIs and institutes in NDL Workshops and VC
- **Self-registration for selective domains**
 - ernet, ac, res, nic, gov
 - Many users don't have e-mail id in these domains
- **In addition to CFTIs, UGC & AICTE approved Institutes have been approached to send user list for bulk registration**
- **Institutional Registration Process Planned**



Popularization Drives



13

- Regular update through Facebook (<https://www.facebook.com/NDLIndia/>)
- Promo video being hosted in YouTube
- PR Agency being appointed for promotion
- Mobile App under development; to be launched in near future
- Google Indexing of NDL site



HRM Review

14

OBSERVATIONS & RECOMMENDATIONS



Hon'ble HRM Review



15

- Prof. P. P. Chakrabarti, PI-NDL Project & Director IIT Kharagpur, made a presentation on NDL to Hon'ble HRM on 26-Jul-16
- Hon'ble HRM reviewed the project and following actions were identified:
 - HRM desires that Botanical Survey of India (BSI) and Zoological Survey of India (ZSI) materials to be linked to NDL
 - User feedback and action taken on these feedbacks to be presented to Hon'ble HRM
 - No. of users registered with NDL very low compared to GER of Higher Education. Necessary steps to be initiated to advertise through social media like LinkedIn, Facebook etc. And also Akashwani (FM) may be approached for publicity purpose
 - A video clip about NDL to be made available and hosted on YouTube
 - Students of UGC and AICTE colleges to be asked to register on the NDL portal through suitable notification by UGC and AICTE



ATR of HRM Review: BSI & ZSI



16

- HRM desires that the Botanical Survey of India (BSI) and Zoological Survey of India (ZSI) materials have to be linked to NDL
 - AS (TE) wrote to Secretary, Ministry of Environment
 - NDL team had been in touch with BSI for sometime and had the last meeting with BSI Director on 13-Aug-16 wherein followings were agreed:
 - ✦ BSI & NDL will work on a broader collaboration; an MoU will be worked out in this respect
 - ✦ A plan for migration of data from BSI metadata schema to NDL metadata schema will be made
 - ✦ NDL will help BSI in their IDR and Herbarium setup on technical points such as machine selection, software developer identification and NKN connection
 - ✦ Both will work on a vision to make a Portal of Biological Sciences with GIS



ATR of HRM Review: BSI & ZSI



17

- NDL team met ZSI Director on 20-Aug-16 wherein followings were agreed:
 - ✦ An MoU for the collaboration will be made
 - ✦ ZSI will collate user data of all its Scientists and Staff and send it to NDL for registration in NDL
 - ✦ ZSI will nominate Nodal Official(s), to coordinate with NDL
 - ✦ NDL, with the help of ZSI, will work out revisions required in its metadata schema to represent fauna related digital resources in NDL and corresponding mapping
 - ✦ NDL will share its IDR Workshop schedule with ZSI so that ZSI can send their representatives to attend these workshops



ATR of HRM Review: User Feedback



18

- **User feedback and action taken on these feedbacks to be presented to Hon'ble HRM**
 - 5216 feedback have been received till 18-Aug-16
 - 20% are positive feedback: No action required
 - Feedbacks on which actions required, classified in 2 categories:
 - ✦ Interface & Search results related
 - ✦ Content related
 - Interface related
 - Graphics design of the Landing page modified and its software implementation is in advanced stage
 - Different sources have different page design. To provide uniform look and feel to users while accessing content from different sources, a transcoding system has been designed and tried out in pilot mode. Deployment of the same in Live system will be taken once the new lot servers are operational



ATR of HRM Review: User Feedback



19

○ Search results related

- ✦ Search engine (Solr) parameter tuning done to improve ranking of search results
- ✦ To address user frustration of content (full-text) not being accessible for some sources after clicking the search result, search result will display content status as one of the following:
 - “Open” (accessible from anywhere)
 - “ Selectively subscribed” (accessible from institutional network who have subscribed to the source)
 - “ Subscription/purchase required”
 - “Registration with the source institute required”
 - “Author to be approached”

New field has been introduced in metadata schema for this. Implementation started with sources currently in curation process. Will be made operational progressively, especially for sources which are already Live



ATR of HRM Review: User Feedback



20

○ Content related

- ✦ Some users requesting to include a specific content which he/she is looking for
- ✦ No specific of pattern has yet been observed for such request
- ✦ Whenever any specific pattern or prominent source will be noticed, necessary harvesting or inclusion action will be taken



ATR of HRM Review: User Registration & Publicity



21

- No. of users registered with NDL very low compared to GER of Higher Education. Necessary steps to be initiated to advertise through social media like LinkedIn, Facebook etc. And also Akashwani (FM) may be approached for publicity purpose
 - NDL account in Facebook operational for sometime (<https://www.facebook.com/NDLIndia/>) through which regular updates and events of NDL propagated
 - PR agency being appointed to draw up a comprehensive plan and take actions related to Publicity, Marketing and Branding



ATR of HRM Review: User Registration & Publicity



22

- **Video clip about NDL to be made available and hosted on YouTube**
 - Video clip made; being hosted on YouTube
- **Students of UGC and AICTE colleges to be asked to register on NDL portal through suitable notification by UGC and AICTE**
 - Notification sent to UGC and AICTE
 - UGC requested its institutes to get in touch with NDL directly
 - Institutes have started contacting NDL who are being asked to send their user data to NDL
 - A few institutes already sent data and these users registered in NDL
 - AICTE sent a list of Heads of 50 institutes to NDL. NDL has asked these Heads to send their user data to NDL
 - AICTE is preparing a list of Heads of another 150 institutes and will send the same to NDL soon to get their user data



PRSG Review

23

OBSERVATIONS & RECOMMENDATIONS



PRSG Meeting

24

- **2nd PRSG Meeting held on 10-Jun-16 at IIT Center, Kolkata**
- **Attended by:**
 - Prof. H. P. Khincha, IISc Bangalore: PRSG Member & Chairman
 - Dr. Jagdish Arora, Director, INFLIBNET: PRSG Member
 - Prof. Uma Kanjilal: IGNOU: PRSG Member
 - Prof. T. V. Prabhakar, IIT Kanpur
 - Prof. Swapan K. Chakravorty: Kabiguru Rabindranath Tagore Distinguished Professor in the Humanities, Presidency University: Member Invitee
- **Followings attended over VC:**
 - Prof. Pushpak Bhattacharya, Director IIT Patna: Member Invitee
 - Dr. Neena Pahuja: Director General, ERNET: Member Invitee
- **Prof. P. S. Mukhopadhyay attended as Invited Library Science Expert**



2nd PRSG Recommendations



25

- Organize a contest to select a name of the Portal: In progress
- Make landing page more informative containing some specific link to contents: Under implementation
- Display in Portal “What’s New” & “Source-wise Last update Status”: Under implementation
- Implement in Advanced Search “Range”, “Boolean”, “Relational” & “Positional Search”
- Implement “Saved Search”, “Search History” & “Context-driven help”
- Make Publicity, Marketing & Branding Plan: PR Agency being appointed
- Make appropriate document for Phase-wise Visualization of the project
- A few other documents for future reference



2nd PRSG Recommendations



26

- Re-appropriation of budget heads (without change of total budget) was discussed and approved
- Release of Rs. 9.71 cr for the current year was recommended



Fund Requirements



27

SUMMARY (All figures in Rs. Crore)

Sl. No.	Items	Original Approval	Proposed Re-appropriation	Budget from 07-Jun-16 to 31-Mar-17
1	Equipment	8.41	13.25	7.09
2	Manpower and Consultant	12.45	12.45	3.75
3	Subscription /Procurement of e-Resources (Support to Institutes to make e-Resources usable by NDL)	15.00	7.16	1.50
4	Training and Awareness Workshops	0.95	2.45	1.25
5	Travel	1.00	2.50	1.25
6	Consumables	1.50	1.50	0.70
7	Contingency	0.50	0.50	0.20
	GRAND TOTAL	39.81	39.81	15.74
	UNSPENT BALANCE (07-Jun-16)			6.03
	FUND REQUIREMENT			9.71



Utilization Certificate



28

SPONSORED RESEARCH AND INDUSTRIAL CONSULTANCY
INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
CONSOLIDATED STATEMENT OF ACCOUNTS
(RECEIPTS & PAYMENTS ACCOUNT FOR THE PERIOD 26/03/2015 TO 06/09/2016)

Title of the Research : "Development of National Digital Library of India, towards Building a National Asset (BNA)"

Sponsoring Agency : MHRD, New Delhi

Name of the Investigator-in-Charge : Prof. Partha P. Chakrabarti & Prof. Partha Pratim Das Department : Central Library

Date of Commencement : 26/03/2015

Date of Termination : 25/03/2018

Receipts			Payments							
Year	Grant	Total	Salary/Manpower/ Honorarium	Travel	Consumables	Contingency	Equipment	Misc. Expenditure/ Others	Total	Closing Balance
014-15 *	69700000	69700000	507938	16956	84729	44406	1169598	0	1823627	67876373
015-16	49700000	49700000	6326776	1047730	701356	1252210	38729529	1061406	49119007	68457366
016-17	0	0	27835441	697019	495668	1175847	29581221	1135046	60920242	7537124
Total	119400000	119400000	34670155	1761705	1281753	2472463	69480348	2196452	111862876	7537124

Grants sanctioned for the FY 2014-15 received on next financial year i.e. 2015-16 through online transfer dated: 04/04/2015


 Signature of PI
 with Stamp
Prof. P.P. Das, PI-BNA
 Department of Computer Science & Engineering
 Indian Institute of Technology Kharagpur


 Signature Finance Officer
 with Stamp
S. K. Biswas
 Sr. Administrative Officer (F & PM)
 Sponsored Research & Industrial Consultancy
 I.I.T. Kharagpur- 721302



Fund Release Requirement



29

Sl. #	Item	Amount in Rs. Cr.
1.	Total Sanction (2015-18)	39.80
2.	Fund received as on date	11.94
3.	Total expenses as on 06.9.16	11.19
4.	Unspent balance as on 06.9.16 (#2–#3)	0.75
5.	FUND REQUIRED TO BE RELEASED (as recommended by PRSG)	9.71



Thank You

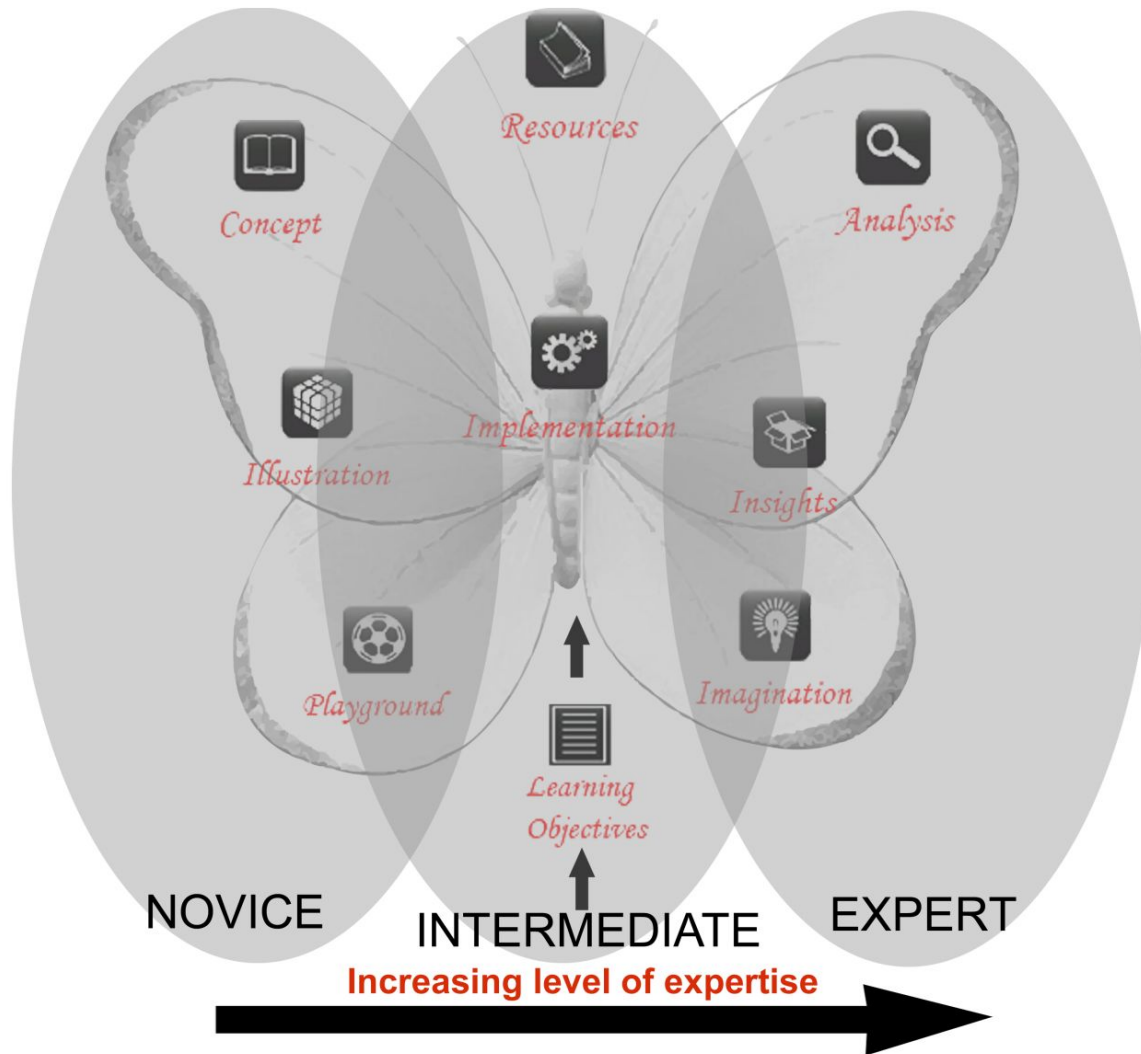
**“Learning by Doing (LbD) based
course content development
in areas of CS and ECE”**

**Venkatesh Choppella
Principal Investigator
IIIT Hyderabad
venkatesh.choppella@iiit.ac.in**

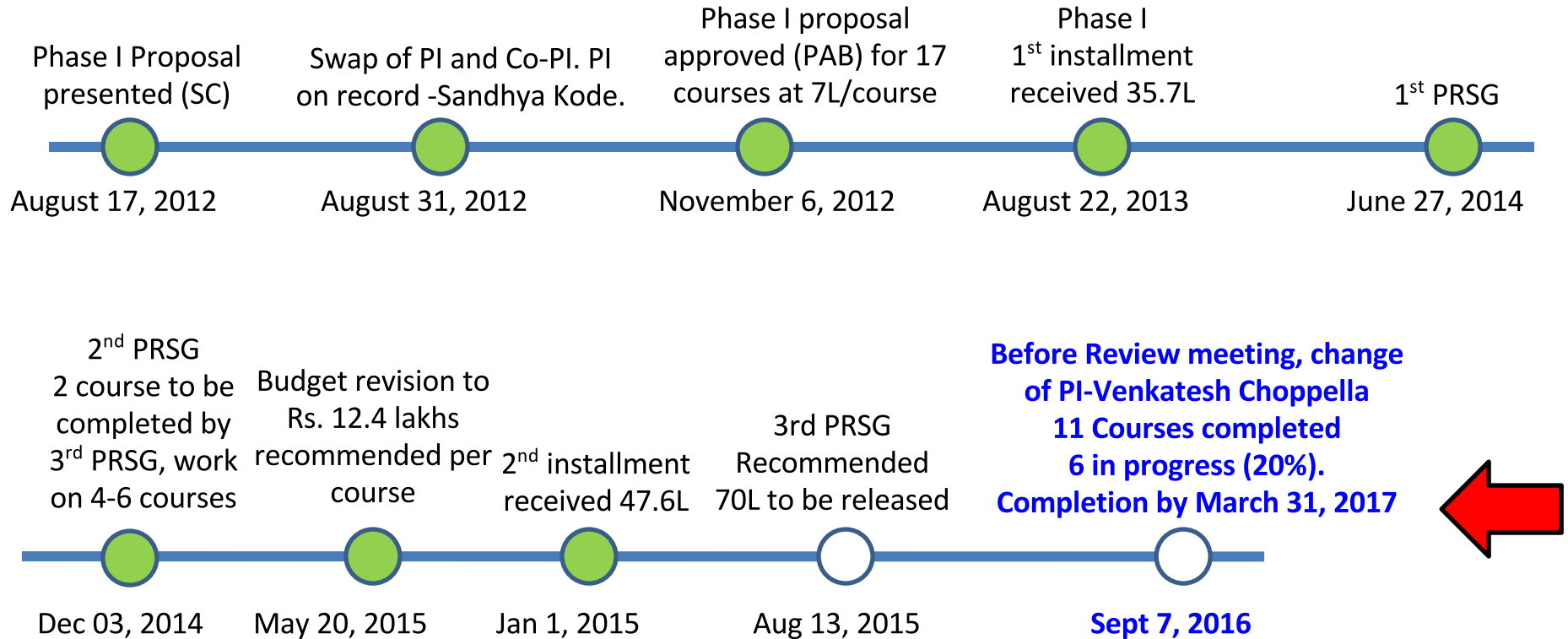
Agenda

- Project Objective: Learning by Doing (LbD)
- Project Status
- Financials
- Conclusion

LbD Model



Phase I Timeline



Project Status

Date	Milestone	Status	Recommendation
2015-08-13	3rd PRSG	9: under dev. 0: delivered	70L to be released
2016-09-07	Review Meeting	6: under dev 11: delivered Funding pending Total staff: 3 animators	

courses uploaded to eAcharya:

http://eacharya.inflibnet.ac.in/search?q=iiit+hyderabad&search-button=Search&field=dins_name&opt=free

All delivered courses uploaded to: <http://enhanceedu.iiit.ac.in/moodle/>

Appendix

list of courses and Status

Delivered Courses	Courses to be delivered
Advanced Topics in Text and Web Mining	Electro Magnetic Theory
DSD Using Verilog	VLSI
Algorithms	Complexity and Advanced Algorithms
Analog Design	Design for Testability
Embedded Systems	Visual Java Development Environment
Data Mining and Data Warehousing	CAD for VLSI
Operating Systems	
Social Networking	
Introduction to e-Governance	
Topics in Embedded Systems	
Solid state Electronic Design	

Status of courses to be delivered

Courses to be delivered	Status (%)
Electro Magnetic Theory	15%
VLSI	15%
Complexity and Advanced Algorithms	5%
Design for Testability	20%
Visual Java Development Environment	18%
CAD for VLSI	20%

Financials

No.	Date	Item	Source	Amt (L)
1	2012-08	17c @ 7L/c	DPR	119.0
2	2013-08	1st installment funding		35.7
3	2015-01	2nd installment funding		47.6
4	2015-08	Renegotiated Budget 10.24L/c x 7c + 12.4L/c x 10c	2015-Aug PRSG	191.36
5	2015-08	Amount recommended for release	2015-Aug PRSG	70
		Amount to be delivered after project completion	2015-Aug PRSG	38.06
6	2016-09	Due	2015-Aug PRSG	108.06

Conclusion

PRSG recommendation sought for:

- Immediate release of 70 lakhs as recommended during the PRSG 3 meeting on 13 August 2015
- Delivery of remaining 6 courses by Jun 2017

Thank you



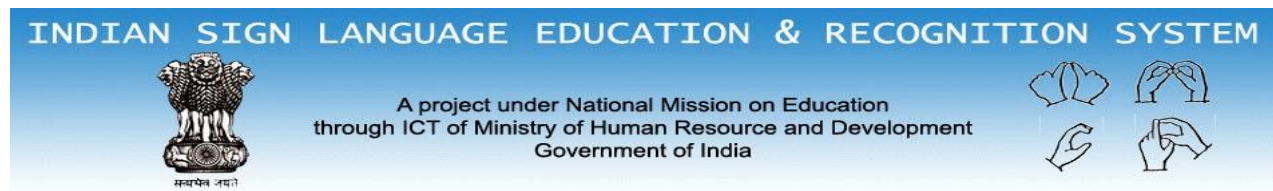
Main Phase Project Proposal
on
Development of Indian Sign Language
Education and Recognition Platform for
Hearing Impaired Students of India

<http://www.iitg.ernet.in/isl/>

Submitted to

The Department of Higher Education

Ministry of Human Resource Development,
Govt. of India



Project title: Development of an Indian Sign Language Education and Recognition Platform for Hearing Impaired Students of India.

Objectives as per the Mission Document:

Development of interfaces for other cognitive faculties which would also help physically challenged learners.

Organizing Institute:

Indian Institute of Technology, Guwahati, India.

Principal investigator: Dr. Manas Kamal Bhuyan.
Associate Professor,
Department of Electronics & Electrical Engineering,
Indian Institute of Technology Guwahati, Assam, India.
PIN: 781039.
Tel: +91-361-258-2523 (O), Fax: +91-361-2582542
E-mail: mkb@iitg.ernet.in

Co-Investigator: Dr. Prabin Kumar Bora.
Professor,
Department of Electronics & Electrical Engineering,
Indian Institute of Technology Guwahati, Assam, India.
PIN: 781039.
Tel: +91-361-258-2502 (O), Fax: +91-361-2582542
E-mail: prabin@iitg.ernet.in

Participating Institutes:

Deaf and Dumb Educational Institutes/Schools of India including Ali Yavar Jung National Institute for the Hearing Handicapped, Mumbai, India. Most specifically, the institutes of its kind in the entire North-Eastern region of India are now participating in this project. Moreover, Engineering Colleges/Institutes of the North-Eastern region are now also contributing towards the goal of this project.

Project period: 36 months.

Beneficiaries: Hearing impaired/mute students of India.

Introduction:

Sign languages are natural languages that use different means of expression for communication in everyday life. More particularly, it is the only means of communication for the hearing impaired. Thus, it offers enhancement of communication capabilities among normal beings and provides replacement for speech among deaf and mute people. Because of these, automatic sign language recognition has attracted vision researchers for long. Several research works are going on sign language in order to make the communication between a deaf person and a normal person easy. Examples of some sign languages are the American Sign Language, the British Sign Language, the native Indian Sign Language, the Japanese Sign Language, and so on. Generally, the semantic meanings of the language components in all these sign languages differ, but there are signs with a universal syntax. For example, a simple gesture with one hand expressing 'hi' or 'goodbye' has the same meaning all over the world and in all forms of sign languages. In a sign language, the signs are generated by combinations of hand motions and finger gestures, frequently augmented with mouth movements according to the spoken language. Hand motions are distinguished from one sign to another by the spatial motion pattern, the speed, and in particular by the body parts that the signer touches at the beginning, during or at the end of a sign. In addition to the hand movement, the finger configuration during the slower parts of the hand movements also provides significant meaning to a gesture.

Sign languages are well structured languages with a phonology, morphology, syntax and grammar distinctive from spoken languages. The structure of a spoken language makes use of words linearly, *i.e.*, one after the other, whereas a sign language makes use of several body movements parallelly in the spatial as well as in temporal space. The linguistic characteristics of a sign language are different than that of spoken languages due to the existence of several components affecting the context such as the use of facial expressions and head movements in addition to the hand movements.

Some common facts regarding sign languages are as follows-

1. Sign languages are the pictorial representation of spoken languages.
2. Sign language is an integral part and an identifying feature of membership in the deaf culture.
3. Expressing hidden meaning is not possible in sign language.
4. Sign language has its own grammatical structure independent of any spoken or written languages.
5. The majority of deaf children are born to hearing parents and therefore do not acquire sign language as a mother tongue. They need to learn it at schools.
6. Minority of deaf children are born to deaf parents. They acquire sign language as a mother tongue.

7. According to some studies, children can learn sign language earlier than they can learn to speak.

Motivation of the Project:

Sign language is very popular among the deaf community. But the people who are not deaf never try to learn the sign language for interacting with the deaf people. This becomes a cause of isolation of the deaf people. If the computer can be programmed in such a way that it can translate sign language to some speech or text format, the difference between the normal people and the deaf community can be minimized. This project is aimed to develop an automatic Indian Sign Language Education and Recognition Platform for hearing impaired student of India.

Goals and Objectives of the Project:

This project is aimed to develop an automatic Indian Sign Language Education and Recognition Platform for hearing impaired student of India. The system can substantially help in the primary/vocational/higher education of hearing impaired student and people of India. The framework is proposed to be extended to 14 different languages of India with extensive interactive features in the audio-visual mode.

Another important aspect of the project is that, the proposed interactive system will be able to recognize different hand/body gestures of Indian Sign Language and the system can give the interpretation of the recognized gestures in the form of some text messages displayed in the computer monitor along with audio interpretation. The same module can be used as a gesture recognition system as well as a gesture animation system and it would be quite useful in the educational process of hearing impaired/mute students of India.

The important motivation of the proposed research/project is to develop an Indian Sign Language Recognition platform for mute people. Automatic sign language recognition offers enhancement of communication capabilities for the speech and hearing impaired, promising improved social opportunities and integration.

The objective of the proposed research/project work is to build a system that uses natural gestures as a modality for recognition in the vision-based and/or glove-based setup. The focus of the proposed project is to develop a Human Computer Interaction (HCI) platform in context to Indian Sign Language. The development of a system for translating Indian sign language into spoken language would be great help for deaf as well as hearing people of our country. In a country like India there is a need of automatic sign language recognition system, which can cater the need of hearing impaired people. Unfortunately, not much research works on Indian Sign Language recognition is reported till date.

Moreover, there is no officially recognized Indian Sign Language system. The ultimate gain of the proposed system would be enormous. The student will get acquainted with a comparatively latest technology in the form of HCI. We can even think of commercialization of the research outcomes in this area.

Project deliverables:

Automatic Indian Sign Language Recognition Platform for hearing impaired/mute people of India. More specifically, the system would be quite useful for the hearing impaired students of India.

Scope of Work:

In order to pursue the goals of the project the following points are identified as essential-

1. Designing the prototype of Indian sign language education and recognition system.
2. Gathering information regarding different regional sign languages of India.
3. Creating skeleton of various signs and storing them into database for an interactive online environment.
4. Capturing gestures by the use of hand gloves or camera.
5. Making the computer understand different gestures of different sign languages and animating different gestures in real time.

Work plan:

Following few fundamental steps have to be followed for practical implementation of the project:

- **Study of wide classes/varieties of sign language all over the India:** This is the most fundamental step but equally critical phase of the development. Extensive analysis/research of different sign languages of India is required for the creation of a most generalized/unique system.
- **Creation of extensive database:** This is the most crucial step of the project. Our ultimate objective is to create an audio/video database for all the sign languages of India.
- **Audio/Video analysis:** Audio/Video analysis is another very important aspect of developing an integrated and generalized learning methodology of sign languages.
- **Generalized platform for extensive education:** This is the final step of the sign language education system. The proposed interactive system will have both audio and video materials/components for proper primary/higher education for the hearing impaired students of India.
- **Development of a more generalized hand gesture model and verifying the model behavior for wide classes of hand gestures:** Both static and dynamic hand gestures will be considered for the development of a generalized model, where the spatio-temporal variation will be exclusively taken into consideration. Subsequently, we have to resolve some critical issues related to the continuous hand gesture recognition for fluent sign language recognition.
- **Development of the hand gesture recognition algorithm:** Next phase is the development/implementation of suitable image processing algorithms along with some

advanced pattern recognition modules. Subsequently, codes are to be developed for the selected/developed algorithms to implement it in a real time and complex scenario.

- **Testing the hand gesture interface:** The interface is to be tested until it is error-free.
- **Building the prototype recognition system with full capability:** Field testing and improving different algorithms for successful implementation in a real-time error free automatic recognition platform.
- **Final product:** Assembling all the hardware and software modules for a sophisticated Indian Sign Language Education and Recognition System and handing over the software module to MHRD for possible deployment in the Deaf and Dumb Schools of India.

PILOT PHASE DETAILED PROJECT REPORT

The main motivation of the proposed research/project is to develop an Indian Sign Language education/recognition platform for mute people. The goal of this project was to develop a system that can substantially help in the primary/higher and/or vocational education of hearing impaired students/people of India. The framework is proposed to extend to 14 different languages with extensive interactive features in the audio-visual mode. Against each alphabet, number, word and sentence a multimedia comprising of audio and video will be played to interpret them. Moreover, there will be provision for text and animation describing the interpretation process. We have planned to add more features like provision of online courses, interactive session in sign language etc. The another important aspect is that, the system can recognize different hand gestures of Indian Sign Language in the form of some text messages displayed in the computer monitor.

The project work was divided into two major parts for the fulfillment of different demands of deaf community. The first objective was the up liftmen of deaf community in the field of education. Second one is to make the conversation between a deaf and a normal person easy even though the normal person does not have any exposure of sign language. For fulfilling the first need, an attractive GUI based audio-visual platform is being developed which will act as an Indian Sign Language Dictionary in alphabet, word and sentence level. Secondly, a functioning sign language recognition system can provide an opportunity for the deaf to communicate with non-signing people without the need for an interpreter. Recognition of a sign language is very important not only from the engineering point of view but also for its impact on the human society. A sign language recognition platform can be used to generate speech or text making the deaf more independent. Unfortunately, there has not been any system with these capabilities so far. Research has been limited to small-scale systems capable of recognizing a minimal subset of a full sign language. The reason for this is the difficulty in recognizing a full sign language vocabulary – recognition of gestures representing words and sentences undoubtedly is the most difficult problem in the context of gesture recognition research.

We received the first installment of the sanctioned amount on 14.07.2009 and as such, we could start our activities only after this. We have almost completed the first part of the project and fulfill most of the objectives of the pilot phase of the project.

Plan of Action:

Pilot Phase:

The pilot study was conducted in three phases which are as follows:

Part 1: Literature Study (Study of wide varieties of Sign Language all over the India) [Completed].

Part 2: Creation of an Extensive Database [Completed].

Part 3: Audio/Video Analysis [Completed].

Part 4: Generalized Platform for Sign Language Education [Completed]

Future Enhancements:

Part 5: Development of Hand Gesture Recognition Module.

Part 6: Testing the Hand Gesture linterface.

Part 7: Building the Prototype Recognition System with Full Capability.

Work Accomplished:

The pilot phase work has been completed. We have the following satisfactory outcomes after the completion of the pilot phase-

1. Launch of the project website.
2. Around 100 gestures have been recognized in a vision-based setup.
3. Developed some novel gesture recognition algorithms and we are getting desired accuracy by the proposed pattern recognition algorithms.
4. Development of an extensive sign language database and different alphabets, numbers and words have been interpreted by skillful interpreters/experts.
5. We are now able to access different interpreting clips against appropriate alphabets, numbers and words from the database.
6. Different signs have been animated to get three dimensional views of signs.
7. An online dictionary of signs has been prepared to provide textual representations of signs.

Time Schedule:

Time schedule of different activities related to the project in the pilot phase are as follows-

Months from Project Start	Activity	Status
1	Deciding equipment and software specification	Completed
2	Call for Quotations	Completed
3	Ordering & procurement of items	Completed
4	Installation of Items	Completed
5	Setting up of a test bed for preliminary studies	Completed
6	Refinement of test bed setup for carrying out various experiments and R&D activities	Completed
7	Testing and improving algorithms	Partially completed
8	Full integration of software modules for field testing.	Partially completed
9-14	Documentation of Project	Partially completed

Current financial position:

Amount sanctioned for the pilot phase: Rs. 132 Lakhs.

Amount received: Rs. 132 Lakhs

Total expenditure till date*: Rs. 132 Lakhs

Balance amount: NIL

* Expenditure also includes funds committed for the procurement of equipments and payment to the experts.

Summary of the project : Sign language is very popular among the deaf community. But the people who are not deaf never try to learn the sign language for interacting with the deaf people. This becomes a cause of isolation of the deaf people. If the computer can be programmed in such a way that it can translate sign language to some speech or text format, the difference between the normal people and the deaf community can be minimized. This project is aimed to develop an automatic Indian Sign Language Education and Recognition Platform for hearing impaired student of India.

The objective of the proposed research/project work is to build a system that uses natural gestures as a modality for recognition in the vision-based and/or glove-based setup. The focus of the proposed project is to develop a Human Computer Interaction (HCI) platform in context to Indian Sign Language. The development of a system for translating Indian sign language into spoken language would be great help for deaf as well as hearing people of our country. In a country like India there is a need of automatic sign language recognition system, which can cater the need of hearing impaired people. Unfortunately, not much research works on Indian Sign Language recognition is reported till date.

Deliverables (year-wise), as mentioned in DPR:

Year	Activity	Status
2009-2010	Deciding equipment and software specifications, Setting up of a test bed for preliminary studies, Refinement of test bed setup for carrying out various experiments and R&D activities	Completed
2011	Development of Indian Sign Language Education platform	Completed
2012	Development of Data Glove for HCI, and recognition of gestures in a vision-based setup	Completed
2013	Full integration of software modules for field testing, Documentation of Intermediate results of the project	Completed The project had also won the National Award for best applied research and technological innovation. Video Link: http://www.youtube.com/watch?v=7e65nRCMMMM
2014	Development of a complete gesture recognition platform, application of this frame of for sign language recognition, extension of the proposed method for recognizing sign languages of 14 languages of India.	Not Completed as the main phase of the project is not sanctioned till date. We don't have fund to continue the project, and the financial constraints bring this project to a standstill.
2015	Development of gesture animation framework for Indian Sign Language	Not Completed as the main phase of the project is not sanctioned till date. We don't have fund to continue the project, and the financial constraints bring this project to a standstill.

Deliverables achieved so far with details of the work done by the project team

The main motivation of the proposed research/project is to develop an Indian Sign Language education/recognition platform for mute people. The goal of this project was to develop a system that can substantially help in the primary/higher and/or vocational education of hearing impaired students/people of India. A multimedia comprising of audio and video will be played for each alphabet, number, word and sentence for interpreting them. Moreover, there will be a provision for text and animation describing the interpretation process. We have planned to add more features like provision of online courses, interactive session in sign language etc. The another important aspect is that, the system can recognize different hand gestures of Indian Sign Language in the form of some text messages displayed in the computer monitor.

The project work was divided into two major parts for the fulfillment of different demands of deaf community. The first objective was the upliftment of deaf community in the field of education. Second one is to make the conversation between a deaf and a normal person easy even though the normal person does not have any exposure of sign language. For fulfilling the first need, an attractive GUI based audio-visual platform is being developed which will act as an Indian Sign Language Dictionary in alphabet, word and sentence level. Secondly, a functioning sign language recognition system can provide an opportunity for the deaf to communicate with non-signing people without the need for an interpreter. Recognition of a sign language is very important not only from the engineering point of view but also for its impact on the human society. A sign language recognition platform can be used to generate speech or text making the deaf more independent. Unfortunately, there has not been any system with these capabilities so far. Research has been limited to small-scale systems capable of recognizing a minimal subset of a full sign language. The reason for this is the difficulty in recognizing a full sign language vocabulary – recognition of gestures representing words and sentences undoubtedly is the most difficult problem in the context of gesture recognition research.

We completed the first part of the project and fulfilled the most of the objectives of the pilot phase of the project.

The outcomes of the project, as stated in DPR contributing to mission objective

Till now the pilot phase work has been completed. We have the following satisfactory outcomes after the completion of the pilot phase-

1. Launch of educational portal for web learning of Indian Sign Language and development of a new laboratory for HCI research.
2. More than hundred gestures have been recognized in vision-based and glove-based setup.
3. We are getting desired efficiency in pattern recognition with the help of novel gesture recognition algorithms developed.
4. Video clips, audio descriptions, a few animations and text descriptions of different signs are made available.
5. Different signs have been animated in three dimensional views to provide a clearer picture of signs.
6. A dictionary of signs is prepared to provide user a textual description of signs.

The outcomes of the project as achieved on date, with impact assessment done, if any.

The research work so far provides a web-based interactive system for **Indian Sign Language Education and Recognition**.

We have developed a system for hand Gesture Recognition. More than 350 signs (hand gestures) have been recognized by the computer in a Human Computer Interactive environment. A sign displayed in front of a camera or performed by using a data gloves can be processed by a computer to give textual description of the sign. So far, we have come out with the real-time recognition of alphabets, numbers (fingertips detection both single-handed and double-handed) and some words. The main objective of this part of the research/project is the elimination of social isolation of the deaf community by recognizing hand gestures/signs. Recognition of gestures would establish an interaction between a normal person (who may be unaware of Indian sign language) and a deaf person, which may be feasible in near future.

Additionally, we have developed a web-based portal for extensive Indian sign language education. **This part of the research is currently supported by MHRD, Govt. of India under National Mission for Education through ICT** [<http://www.iitg.ernet.in/isl/>]. The database driven web portal avails a learning platform of Indian sign language. The on-line system provides video, audio, animation and textual description of each of the signs of Indian sign language. Further, many features (e.g., search option) that enhance interactivity are also incorporated in the system. So far, signs of alphabets, numbers, different words and sentences have been uploaded in the developed website. With a single click on a particular word, a user can access the corresponding video clip, audio description, animation clip and finally the textual description of the sign. Description of a sign in different modes eliminates the difficulty in learning and makes a sign easily understandable. Hearing-impaired people as well as the normal one can easily interact with this user friendly e-learning interactive environment. This will significantly reduce the communication gap between the hearing impaired/mute people and the normal people.

Additionally, our research work is also boosting an important research in the field of Gesture Recognition as it covers key issues like Human Computer Interaction and Virtual Realities which is still a blur picture for many researchers particularly for Indian researchers working in this domain.

As explained earlier, the important aspect of the developed system is that, the computer can recognize different hand gestures of Indian sign language in the form of some text messages displayed in the computer monitor. Following few fundamental steps were implemented for practical implementation of the developed system:

(A) Indian Sign Language Recognition System:

- **Development of a more generalized hand gesture model and verifying the model behavior for wide classes of hand gestures:** Both static and dynamic hand gestures are considered for the development of a generalized model, where the spatio-temporal variations are exclusively taken into consideration. Subsequently, I have resolved some critical issues related to the continuous hand gesture recognition for fluent sign language recognition.
- **Development of the hand gesture recognition algorithm:** Next phase is the development/implementation of suitable Image Processing/Computer Vision algorithms along with some advanced pattern recognition modules. Subsequently, codes (Open CV) were developed for the selected/developed algorithms to implement it in a real-time and complex scenario.
- **Testing the hand gesture interface:** Data gloves are designed and subsequently, used for gesture recognition. The interface was tested until it is error-free.
- **Building the prototype recognition and animation system with full capability:** Field testing and improving different algorithms are done for successful implementation in a real-time error free automatic recognition platform. Around 350 gestures have been recognized in a vision-based as well as glove-based setup. Gesture animation system was subsequently developed by measuring

different parameters of the hand and fingers from a gesture video. This module was implemented in the software platform of Open CV and Open GL.

- **Final product:** Finally, all the hardware and software modules are assembled for a more generalized Indian Sign Language Recognition and Education System. We are now planning to hand over the developed software module to some government agencies for possible deployment in the Deaf and Dumb Schools of India.

(B) Indian Sign Language Education System:

- **Study of wide classes/varieties of sign language all over the India:** This is the most fundamental step but equally critical phase of the development. Extensive analysis/research of different sign languages of India has been done for the creation of a most generalized/unique system.
- **Creation of extensive database:** An audio/video database for Indian sign language is created. Audio/Video analysis is another very important aspect of developing an integrated and generalized learning methodology of a sign language. **This part of the research is currently supported by MHRD, Govt. of India under National Mission for Education through ICT [<http://www.iitg.ernet.in/cet/homepage.htm>].**
- **Audio/Video analysis: Generalized platform for extensive education:** This is the final step of the sign language education system. The proposed interactive system has enough audio and video materials/components for extensive education of primary/high school standard hearing impaired students of India.

Some of the results of the entire developed system are highlighted in Figs. 2 – 8.

INDIAN SIGN LANGUAGE RECOGNITION IN A VISION-BASED SETUP



Fig. 2: Some hand gestures of Indian Sign Language which are recognized by the proposed system.



Fig. 3: The developed HCI system for vision-based gesture recognition.



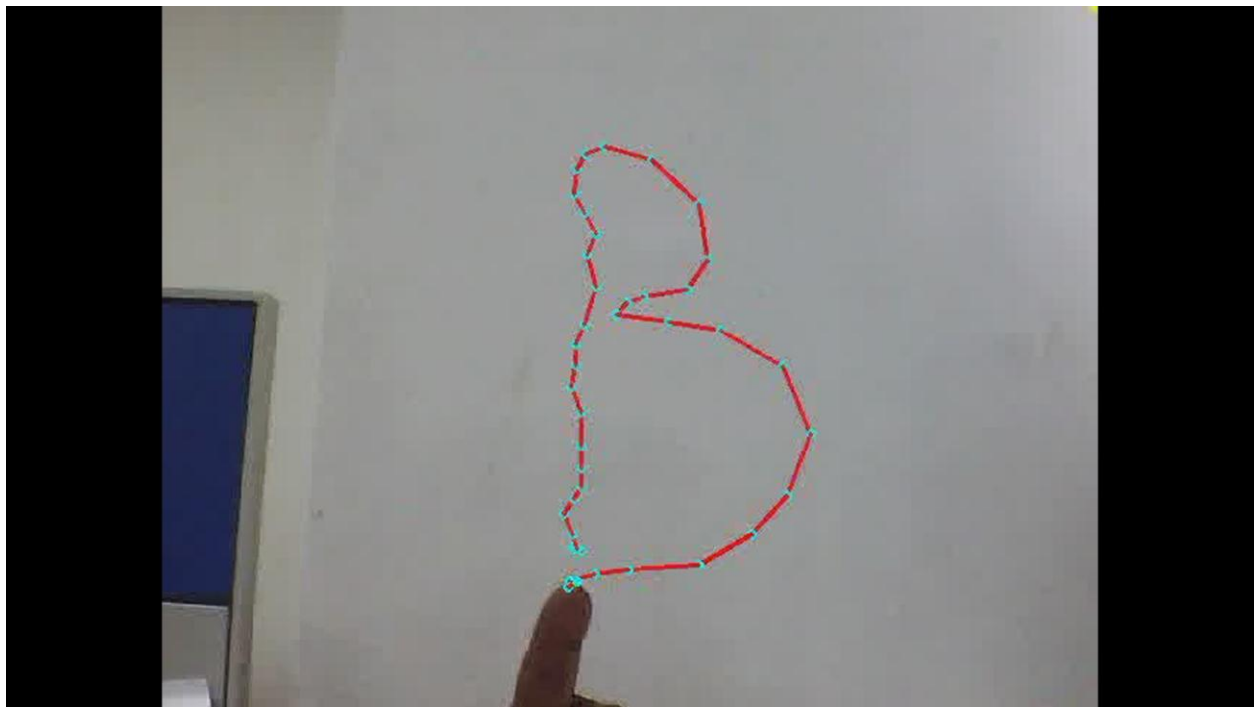
4. (a)



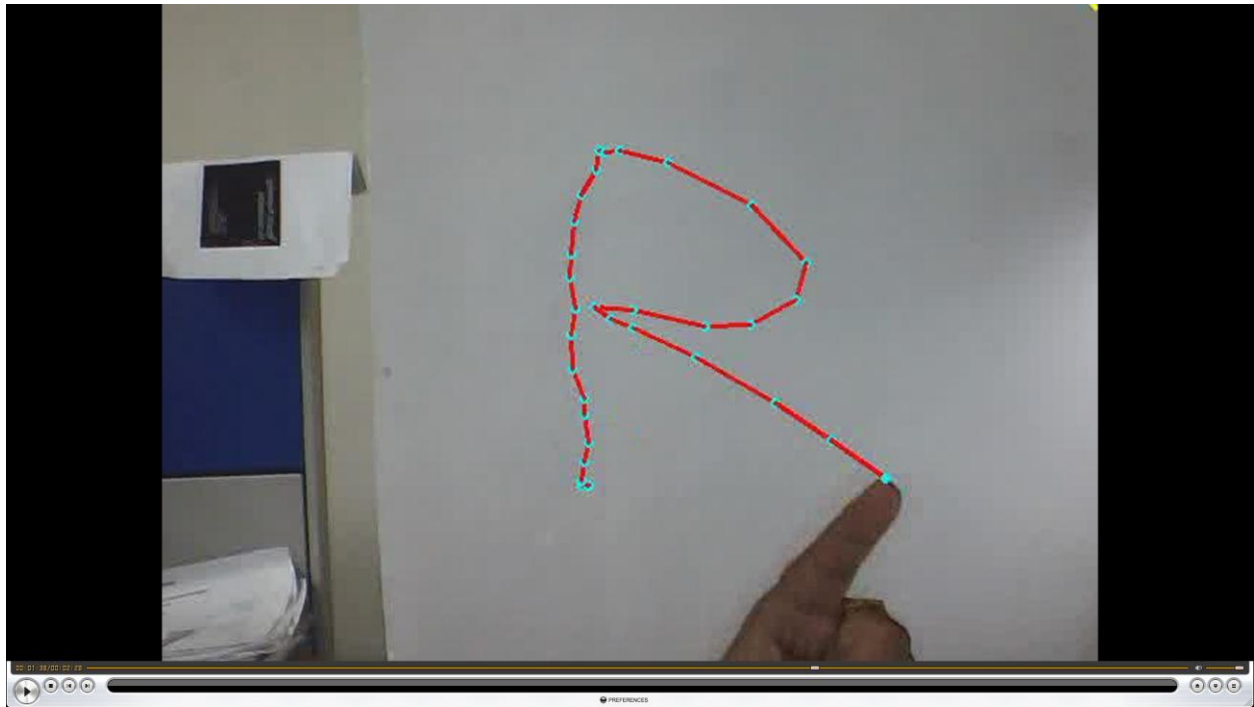
4. (b)



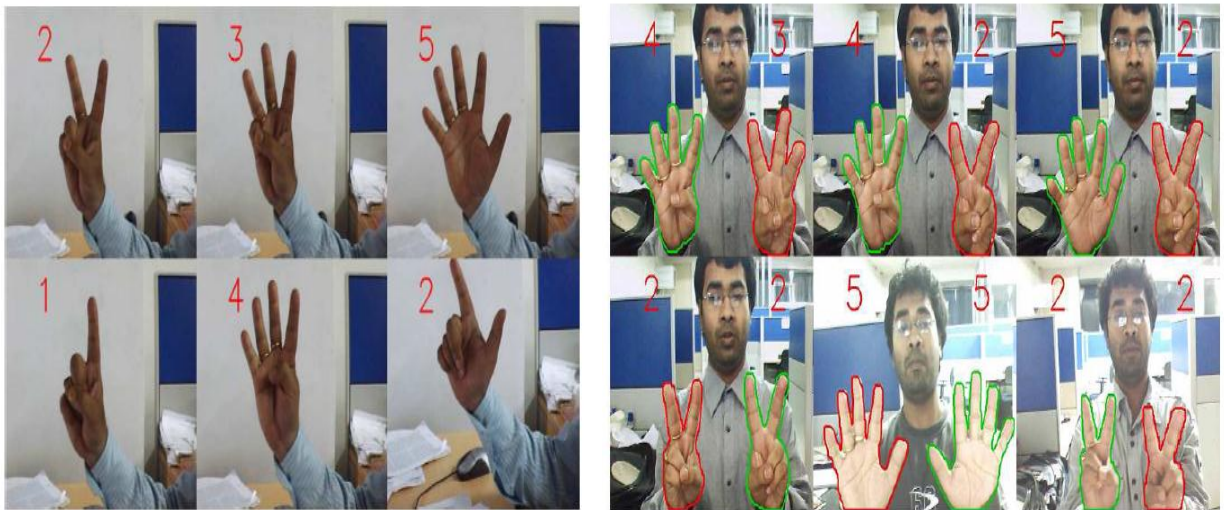
4. (C)



4. (d)



4. (e)

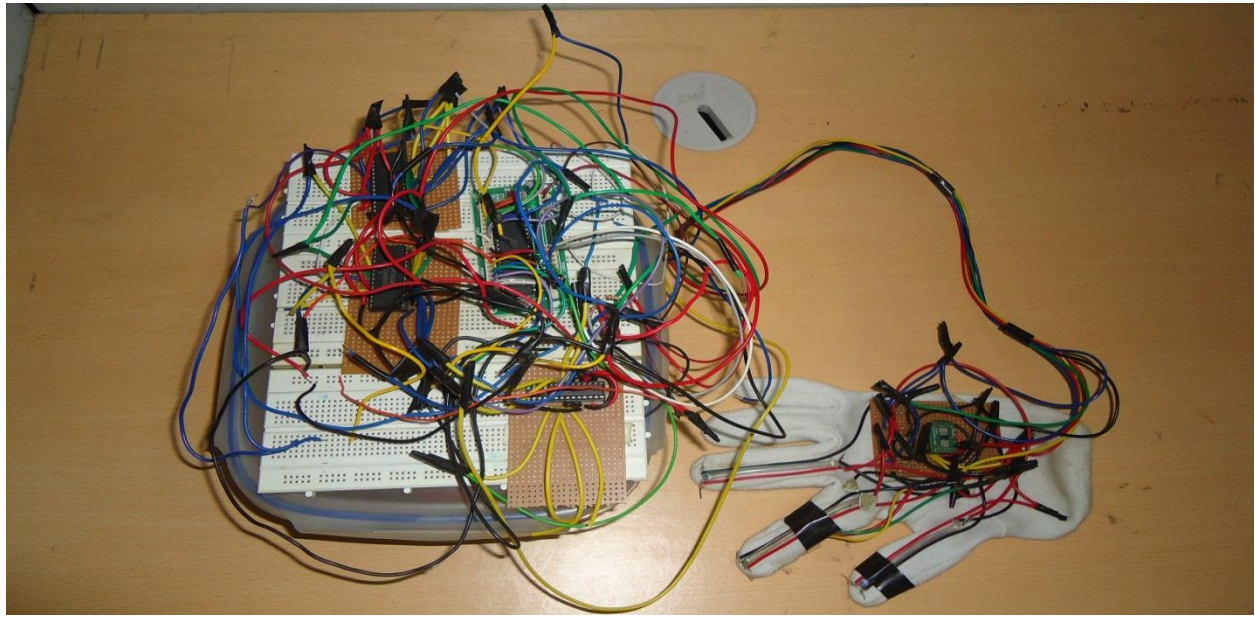


4. (f)

Fig. 4 (a), (b), (c), (d), (e) and (f): Real-time gesture recognition (single and two-handed gestures) in a vision-based setup.

INDIAN SIGN LANGUAGE RECOGNITION IN A GLOVE-BASED SETUP

DESIGNING OF DATA GLOVES



20

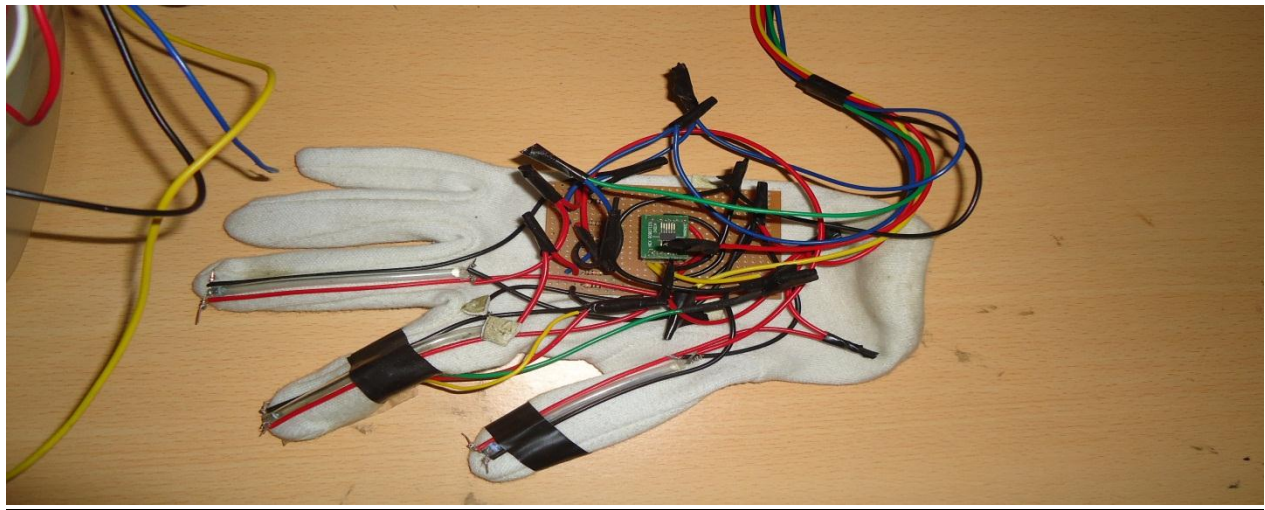


Fig. 5: Data-Gloves for two hands are designed for Indian Sign Language recognition.

GESTURE ANIMATION FRAMEWORK

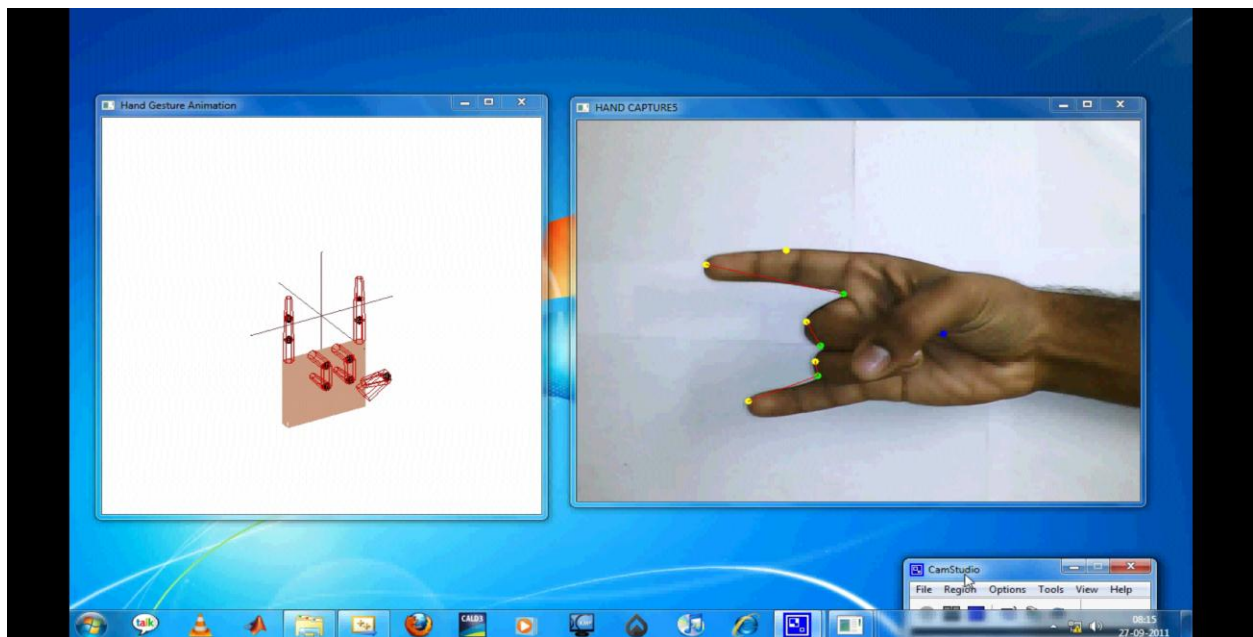
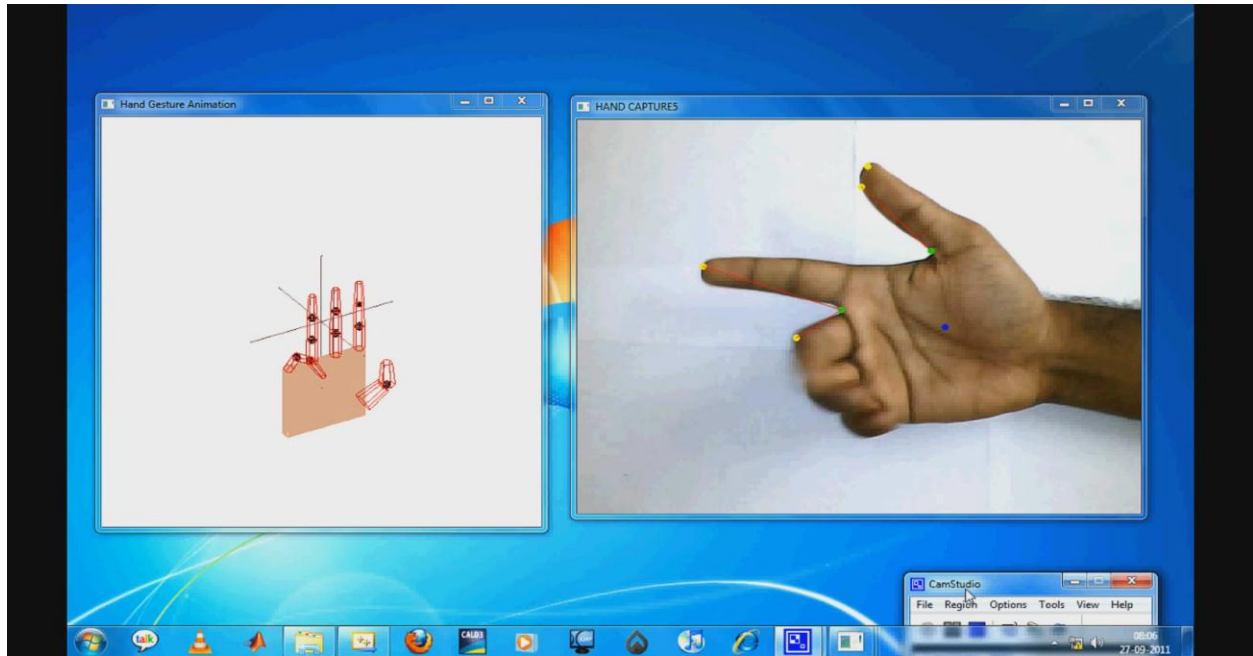


Fig. 7: Indian Sign Language animation framework.

INDIAN SIGN LANGUAGE EDUCATION PLATFORM

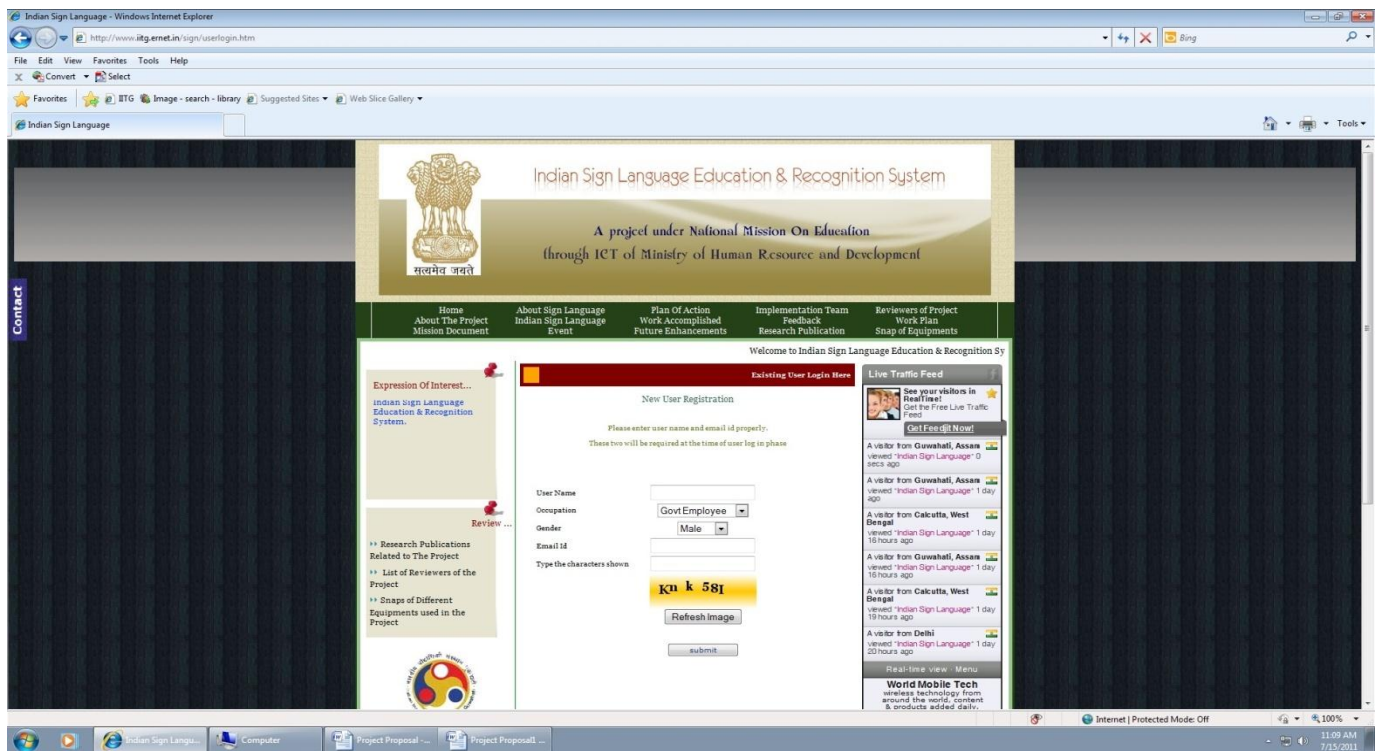


Fig. 8: Indian sign language education platform.

Demonstration and Validation (Test by users)

The developed Indian sign Language Recognition and Education platform was demonstrated in few deaf and dumb schools of India. Furthermore, the developed system was evaluated and validated by some domain experts. Students of some deaf and dumb schools of North Eastern Region of India used the web-based learning system of Indian Sign Language and they found the system totally informative and reliable in understanding signs *i.e.*, sign language education. Also, they were able to make the computer to map their gestures into corresponding text by signing in front of a camera and/or by using a data gloves. Following workshops [<http://www.iitg.ernet.in/isl/>] were conducted for intermediate project evaluation and validation of the proposed system for the pilot phase of the project.

Workshops

1. **Indian Institute of Technology, Guwahati, India:** A workshop at IIT Guwahati was conducted during the month of November, 2011. Mr. Tomohire Morakomi, Inspec Inc., Japan and Yuji Iwahori, Professor, Dept. of Computer Science, Chubu University, Japan attended the workshop. Dr. Arun Banik, Director, National Center for Disability Studies, IGNOU from New Delhi also participated the workshop and delivered a lecture on Assistive Technology for disables. Another workshop was conducted in the month of December, 2011 for verification and validation of the developed online education system. Dr. Arun Banik (Director, NCDS, IGNOU) and Ms Indira Indira Ghosh (ISL Interpreter, AYJNIHH, Kolkata) attended the workshop.

2. **National Institute for Hearing Handicapped, Kolkata, India:**

The implementation team visited National Institute for Hearing Handicapped (NIHH), Kolkata for a demonstration of the project from 29th May, 2012 to 31st May, 2012. During this workshop, a discussion was carried out with the professional sign language interpreters for validating the developed Indian Sign Language database. Additionally, real time class room teaching methodology for hearing impaired students were recorded and included in the developed portal to highlight the requirement of an online sign language education system.

The developed Human Computer Interactive System works perfectly and was tested by some domain experts of India and abroad. Following few domain experts are listed in this regard, who closely inspected/validated the developed system and gave their valuable comments.

- 1) Prof. Arun Banik,
Director,
National Center for Disability Studies, IGNOU,
New Delhi, India.
- 2) Prof. Vinod Kumar,
Professor,
Dept. of Electrical Engineering,
IIT-Roorkee, India.
- 3) Prof. Yuji Iwahori,
Professor,
Dept. of Computer Science and Engineering,
Chubu University, Japan.
- 4) Tomohiro Murakomi,
Inspec Inc.
Japan.
- 5) Dr. A. K. Sinha
Asst. Director,
Ali Yavar Jung National Institute for Hearing Handicapped,
Kolkata, India.
- 6) Mr. Amit Samal
Master Trainer of Indian Sign Language,
Ali Yavar Jung National Institute for Hearing Handicapped,
Kolkata, India.
- 7) Indira Ghosh
Indian sign Language Coordinator/Interpreter,
Ali Yavar Jung National Institute for Hearing Handicapped,
Kolkata, India.
- 8) Mr. Gopal Narayan Dwivedi
Indian Sign Language Interpreter,
Meerut, India.
- 9) Mr. Kshirasindhu Saraf
Hearing impaired student,
Ali Yavar Jung National Institute for Hearing Handicapped,
Kolkata, India.

Social Impact

The project so far provides a web-based interactive system of Indian Sign Language Education and Recognition. Currently, extensive research is going on in the field of gesture recognition. However, there still remain significant problems that need to be solved in gesture recognition, especially in sign language recognition.

The database driven web portal avails a learning platform of Indian Sign Language. The on-line system provides video, audio, animation and textual description of each of the signs of Indian Sign Language. Further, many features (e.g., search option) that enhance interactivity are also incorporated in the system. So far, signs of alphabets, numbers, and different words have been uploaded in the website. With a single click on a particular word, a user can access the corresponding video clip, audio description, animation clip and finally the textual description of the sign. Description of a sign in different modes eliminates the difficulty in learning and makes a sign easily understandable. Hearing-impaired people as well as the normal one can easily interact with this user friendly e-learning interactive environment. This will significantly reduce the communication gap between the hearing impaired/mute people and the normal people.

We have a developed a system for hand Gesture Recognition. More than hundred signs have been recognized by the computer in the Human Computer Interactive Environment. A sign displayed in front of a camera or by using a data gloves can be processed by a computer to give textual description of the sign. So far, we have come out with the recognition of alphabets, numbers (fingertips detection both single-handed and double-handed) and some words. The main objective of this part of the project is the elimination of social isolation of the deaf community by recognizing hand gestures. Recognition of gestures would establish an interaction between a normal person (who may be unaware of Indian Sign Language) and a deaf person, which may be feasible in future.

The project is also boosting an important research in the field of Gesture Recognition as it covers key issues like Human Computer Interaction which is still a blur picture for many researchers working in this domain.

Cost Benefit Analysis

SL. No.	Item	Population (Approx.)	Expense (Rs)	Expense/person (Rs)
1	Deaf people in India	11,00,000	130,00,000	11.80
2	Normal people in India	120,90,93,422	130,00,000	0.01 (approx.)
Total		1210193422	130,00,000	0.01 (approx.)

List of publications related to the developed system:

1. **M.K. Bhuyan**, Debanga Raj Neog and Mithun Kumar Kar, "Fingertip Detection for Hand Pose Recognition", *International Journal of Computer Science and Engineering*, 4(3), ISSN: 0975-3397, pp. 501-511, March, 2012.
 2. **M.K. Bhuyan**, "FSM-based Recognition of Dynamic Hand Gestures via Gesture Summarization Using Key Video Object Planes", *International Journal of Computer and Communication Engineering*, (6), pp. 248-259, 2012.
 3. **M.K. Bhuyan**, D. Ghosh and P.K. Bora, "Recognition of Wide Classes of Continuous Hand Gestures for Human Computer Interaction", *International Journal of Pattern Recognition and Artificial Intelligence, World Scientific*, 25 (2), pp. 227-252, 2011.
 4. **M.K. Bhuyan**, Mithun Kumar Kar and Debanga Raj Neog, "Hand Pose Identification From Monocular Image for Sign Language Recognition", *Proceedings of IEEE International Conference on Signal and Image Processing Applications (ICSIPA 2011)*, Malaysia, November 2011, pp. 378-383.
 5. **M.K. Bhuyan**, Chaitanya Narra and Darsha Sharath Chandra, "Hand Gesture Animation by Key Frame Extraction", *Proceedings of IEEE International Conference on Image Information (ICIIP-2011)*, India, November 2011, pp. 1-6.
 6. **M.K. Bhuyan**, Mithun Kumar Kar and Debanga Raj Neog, "Finger Tips Detection for Two-handed Gesture Recognition," *Proceedings of SPIE 8285, 828516 (2011)*.
 7. **M.K. Bhuyan**, Mithun Kumar Kar and Debanga Raj Neog, "Finger Tips Detection for Two-handed Gesture Recognition," *Proceedings of International IEEE Conference on Graphic and Image Processing (ICGIP 2010)*, Manila, Philippines, December 2010, pp. 4-9.
 8. **M.K. Bhuyan**, Debanga Raj Neog and Mithun Kumar Kar, "Hand Pose Recognition using Geometric Features", *Proceedings of National Conference on Communication (NCC 2011)*, IISC Bangalore, pp.1-5.
 9. **M. K. Bhuyan**, "An Integrated Gesture Recognition Scheme for Human Computer Interactions", *Proceedings of the 12th National Conference on Communications (NCC 2009)*, IIT Guwahati, India, pp.1-4.
-
-

System Development under Pilot Phase of the project

The screenshot shows the user registration interface of the Indian Sign Language Education & Recognition System. The page features a header with the system's name and a project description under the National Mission On Education. A navigation menu includes links for Home, About Sign Language, Plan of Action, Implementation Team, and Reviewers of Project. The main content area is titled 'New User Registration' and contains a form with fields for User Name, Occupation (set to 'Govt Employee'), Gender (set to 'Male'), and Email ID. A CAPTCHA image with the text 'k u k 58j' is displayed below the form. A 'Refresh Image' button and a 'submit' button are also present. On the right side, there is a 'Live Traffic Feed' showing recent visitors from various locations like Guwahati, Assam and Calcutta, West Bengal. The browser's address bar shows the URL 'http://www.itg.ernet.in/sign/userlogin.htm'.

The screenshot displays the main menu of the Indian Sign Language Education & Recognition System. The header and navigation menu are identical to the previous screenshot. The main content area is divided into three sections: 'Word Level Category', 'Gesture Recognition Level', and 'Sentence Level Category'. The 'Word Level Category' section lists various topics such as Alphabets, Art, Entertainment, Audio Visual Equipments, Behaviour Norms, Beverages, Body Parts, Functions, Calendar Items, Cities And Towns, Continents, Countries, Direction, Dishes And Spices, Domestic Animals, Birds, Dressware, Cosmetics, Educational Terms, Family And Relations, Festivals, Fruits, and Games, Sports. The 'Gesture Recognition Level' section includes 'Review Recognition Phase...' with sub-points for Fingertip Detection and Two Handled Fingertip Detection, and a note about gestures having global motions. The 'Sentence Level Category' section lists Interrogative Sentence, Negative Sentence, and Adjective Sentence. A central image shows a man in a blue shirt and tie, with a small circular icon overlaid on his hand. The browser's address bar shows the URL 'http://www.itg.ernet.in/sign/indianSignNew.htm'.

Indian Sign Language - Windows Internet Explorer


http://www.itg.ernet.in/sign/twohandfingertipdetection2.html

File Edit View Favorites Tools Help

Convert Select

Favorites BTG Image - search - library Suggested Sites Web Slice Gallery

Indian Sign Language



Indian Sign Language Education & Recognition System

A project under National Mission On Education
through ICT of Ministry of Human Resource and Development

Contact

Home
About The Project
Mission Document

About Sign Language
Indian Sign Language
Event

Plan Of Action
Work Accomplished
Future Enhancements

Implementation Team
Feedback
Research Publication


Reviewers of Project
Work Plan
Snap of Equipments

Gesture Recognition Level

- Fingertip Detection [I]
- Fingertip Detection [II]
- Fingertip Detection [III]
- Two Handed Fingertip Detection [I]
- Two Handed Fingertip Detection [II]
- Snaps of Different Equipments used in the Project

Indian Sign Language Recognition System

Two Hand Fingertip Detection (Part II)



Login as sign [Logout](#)

Expression Of Interest...

IT Guwahati, India invites academicians, institutions for their active participation/contribution

Review ...

- »» Research Publications Related To The Project
- »» List of Reviewers of the Project
- »» Snaps of Different Equipments used in the Project

Internet | Protected Mode: Off 100% 11:21 AM 7/15/2011

Indian Sign Language - Windows Internet Explorer


http://www.itg.ernet.in/sign/gesture.html

File Edit View Favorites Tools Help

Convert Select

Favorites BTG Image - search - library Suggested Sites Web Slice Gallery

Indian Sign Language



Indian Sign Language Education & Recognition System

A project under National Mission On Education
through ICT of Ministry of Human Resource and Development

Contact

Home
About The Project
Mission Document

About Sign Language
Indian Sign Language
Event

Plan Of Action
Work Accomplished
Future Enhancements

Implementation Team
Feedback
Research Publication

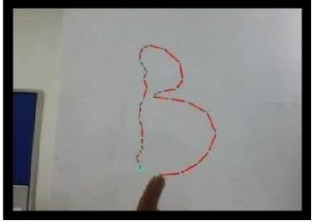
Reviewers of Project
Work Plan
Snap of Equipments

Gesture Recognition Level

- Fingertip Detection [I]
- Fingertip Detection [II]
- Fingertip Detection [III]
- Two Handed Fingertip Detection [I]
- Two Handed Fingertip Detection [II]
- Snaps of Different Equipments used in the Project

Indian Sign Language Recognition System

Gesture Having Global Motion



Login as sign [Logout](#)

Expression Of Interest...

IT Guwahati, India invites academicians, institutions for their active participation/contribution to the development of Indian Sign Language

Review ...

- »» Research Publications Related To The Project
- »» List of Reviewers of the Project
- »» Snaps of Different Equipments used in the Project

Internet | Protected Mode: Off 100% 11:21 AM 7/15/2011

MAIN PHASE PROJECT PROPOSAL

Future Enhancements:

After completion of the pilot phase, we are left with many challenging activities for the successful completion of the project. The activities that have to be completed to get the full outcome of the proposed project are as follows.

1. Recognition of hand gestures using Data Gloves to bring more efficiency.
2. Converting different signs to textual form displayed on the computer screens to minimize the difficulties in communication with the deaf community.
3. To develop an HCI system so that people can interact with the computer directly without the need of mouse, keyboard, joystick or any other input device.
4. Character level, Word level, Sentence level, Paragraph level and finally different course level interpretations are to be implemented.
5. An audio track is to be merged with each sign clips to depict the steps to signing.
6. Interactive session in sign language will be launched.
7. Enhancement in the form of research in Virtual Reality.
8. Development of a complete animated platform.
9. Deployment of the developed system in the Deaf and Dumb Schools of India.

Work Plan:

1. **Creation of extensive database:** This is the most crucial step of the project. Our ultimate objective is to create an audio/video database for all the sign languages of India.
2. **Audio/Video analysis:** Audio/Video analysis is another very important aspect of developing an integrated and generalized learning methodology of sign languages.
3. **Generalized platform for extensive education:** This is the final step of the sign language education system. The proposed interactive system will have both audio and video materials/components for proper primary/higher education for the hearing impaired students of India.
4. **Development of a more generalized hand gesture model and verifying the model behavior for wide classes of hand gestures:** Both static and dynamic hand gestures will be considered for the development of a generalized model, where the spatio-temporal variation will be

exclusively taken into consideration. Subsequently, we have to resolve some critical issues related to the continuous hand gesture recognition for fluent sign language recognition.

5. **Development of the hand gesture recognition algorithm:** Next phase is the development/implementation of suitable image processing algorithms along with some advanced pattern recognition modules. Subsequently, codes are to be developed for the selected/developed algorithms to implement it in a real time and complex scenario.
6. **Testing the hand gesture interface:** The interface is to be tested until it is error-free.
7. **Complete animation setup:** It is proposed to develop an interactive animated system for sign language education.
8. **Research on Virtual Reality:** Extensive research on this emerging research area for possible deployment in sign language education system.
9. **Building the prototype recognition system with full capability:** Field testing and improving different algorithms for successful implementation in a real-time error free automatic recognition platform.
10. **Final product:** Assembling all the hardware and software modules for a sophisticated Indian Sign Language Education and Recognition System and handing over the software module to MHRD for possible deployment in the Deaf and Dumb Schools of India.

Budget proposed for the main phase: 429.41 Lakhs

Budget estimates (Summary): 459.41 Lakhs

	Items	Total (Rs.)
A.	Recurring	
	1.Salaries/wages	70.60 Lakhs
	2. Consumables	25.00 Lakhs
	3. Travel	30.00 Lakhs
	4. Conf. & workshop	55.00 Lakhs
	5. Other cost (Contingencies)	22.36 Lakhs
B.	Equipment	230.65 Lakhs
C.	Honorarium to investigators/Domain Experts/PRSG members	25.8 Lakhs
	Grand total (A+B+C)	459.41 Lakhs

Notes:

1. Eight research associates/scientists will be needed to carry out some of the experimental works involving design and testing.
2. Equipment consists of high-end systems for Image/Video Processing, Servers, Workstations, equipment for virtual reality applications, PCs, Printers, Scanners, Photocopiers, Video Conferencing facilities at multiple campuses, consoles and other audio-video equipment, animation platform including related software, magnetic sensors for tracking

systems, setup of servers, computers and the installation of related software, Magnetic sensors for tracking systems, Set up of servers, computers and installation of software in different nodal centers (e.g., Deaf and Dumb educational institutes) of the project.

3. Travel includes attending conferences /workshops/seminars (national and international) to present and discuss about research findings from the project and gaining knowledge regarding latest advancements in the related area. Furthermore, for data collections of Indian Sign Language and for the interactions with the deaf/dumb students, we have to visit different places of India. Finally, I am planning to visit some of the deaf and dumb institutes of India to demonstrate the developed system. Subsequently, I would like to train some of the teachers/volunteers to use the system more effectively. Also, the budget includes the cost of holding PRSG meetings.
4. Contingency is needed to buy books/periodicals to keep abreast of latest developments in the area of research.
5. Some very sophisticated equipment like very high end computing systems, sophisticated data acquisition systems etc. are needed for design, implementation and testing of proposed Indian Sign Language interface system. The cost includes transport, insurance and installation charges.
6. Expenditure related to the Conference & Workshop includes organization of some conference/workshop/symposia related to Sign Language Recognition in the national/international level. We are planning to involve deaf/dumb students of India in this process of knowledge/information sharing.
7. Travel expenditure related to visiting different states for data collection while developing the platform for 14 regional languages.

Development of an Indian Sign Language Education & Recognition Platform for Hearing Impaired Students of India

*A Project Under National Mission for Education through ICT, MHRD,
Government of India*



<http://www.iitg.ernet.in/isl/index.htm>

Indian Institute of Technology Guwahati, India.



Contents



Introduction

Goals & Objectives

Fundamental Concepts

Project Development

Other Important Information

Development of an Indian Sign Language Education and Recognition Platform for Hearing Impaired Students of India

<http://www.iitg.ernet.in/isl/index.htm>

❖ Principal Investigator:

Dr. M. K. Bhuyan

Visiting Professor, University of Purdue, Indianapolis, USA.

Associate Professor, Department of EEE, IIT Guwahati, India.

❖ Co-Investigator:

Prof. P.K. Bora

Professor, Department of EEE, IIT Guwahati, India.

Project Deliverables

Automatic Indian Sign Language Recognition and Education Platform for hearing impaired/mute people of India. More specifically, the system would be quite useful for the hearing impaired students of India.

**National Institute for
Orthopaedically Handicapped,
Kolkata, India**

**Ali Yavar Jung National Institute
for the Hearing
Handicapped, Mumbai, India.**

**Deaf and Dumb Educational
Institutes/Schools of
North-Eastern region of India.**

**Organizing Institute
Indian Institute of
Technology Guwahati,
India.**

OBJECTIVE & MOTIVATION

- This project is aimed to develop an Indian Sign Language Education and Recognition Platform for hearing impaired student of India. The system can substantially help in the primary/vocational/higher education of hearing impaired student and people of India.
- The important motivation of the project is to develop an Indian Sign Language Recognition platform for mute people. Automatic sign language recognition offers enhancement of communication capabilities for the speech and hearing impaired, promising improved social opportunities and integration.
- The objective of the research is to build a system that uses natural gestures as a modality for recognition in the vision-based and/or glove-based setup. The focus of the proposed project is to develop a Human Computer Interaction (HCI) platform in context to Indian Sign Language.
- **Objectives as per the Mission Document:** Development of interfaces for other cognitive faculties which would also help physically challenged learners.

Sign Language

What ?

Sign languages are natural languages that use different means of expression for communication for hearing impaired.

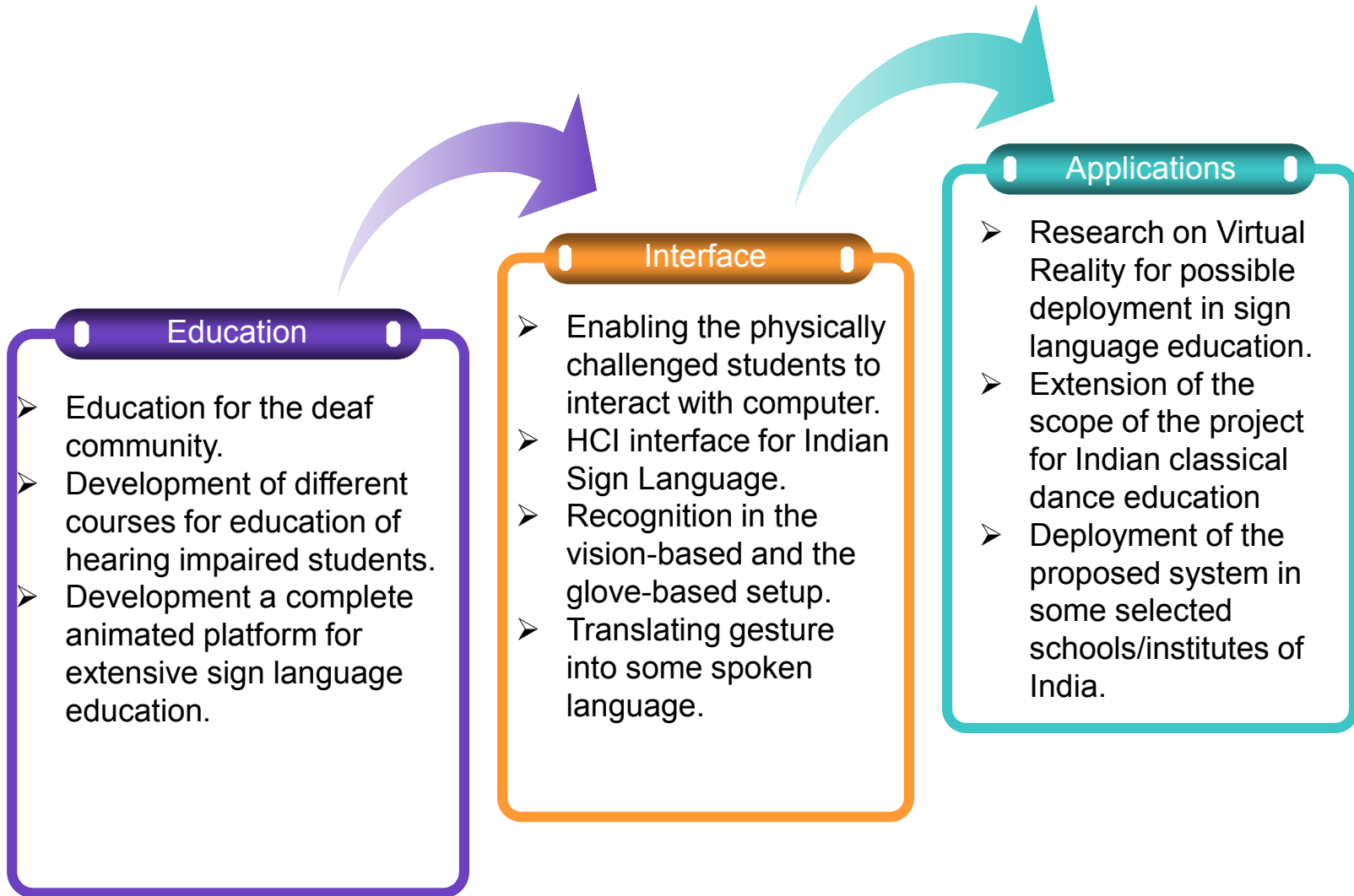
Why ?

Sign language offers enhancement of communication capabilities among normal beings and provide replacement of speech among deaf and mute people.

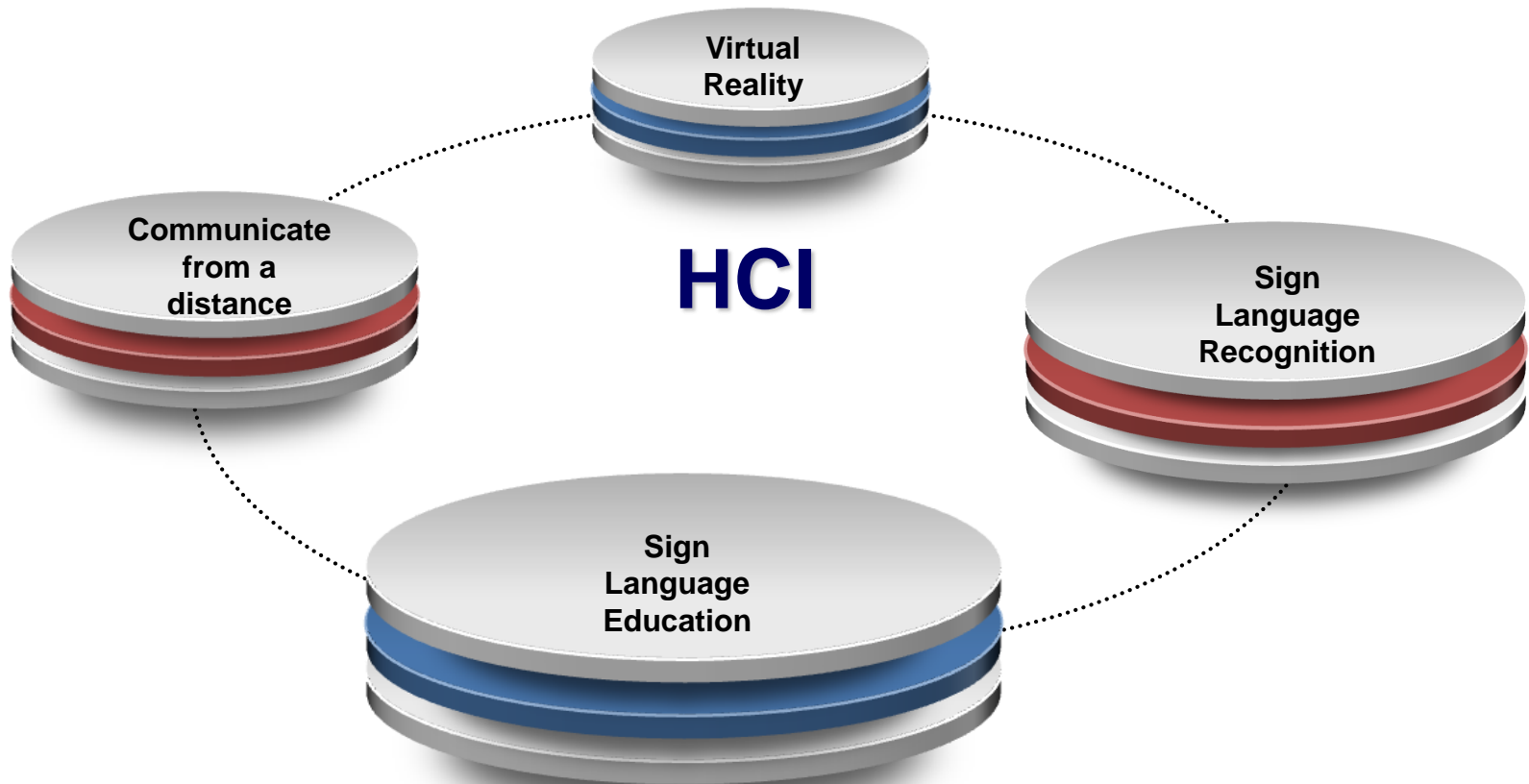
How ?

Development of interfaces for other cognitive faculties which would also help physically challenged learners.

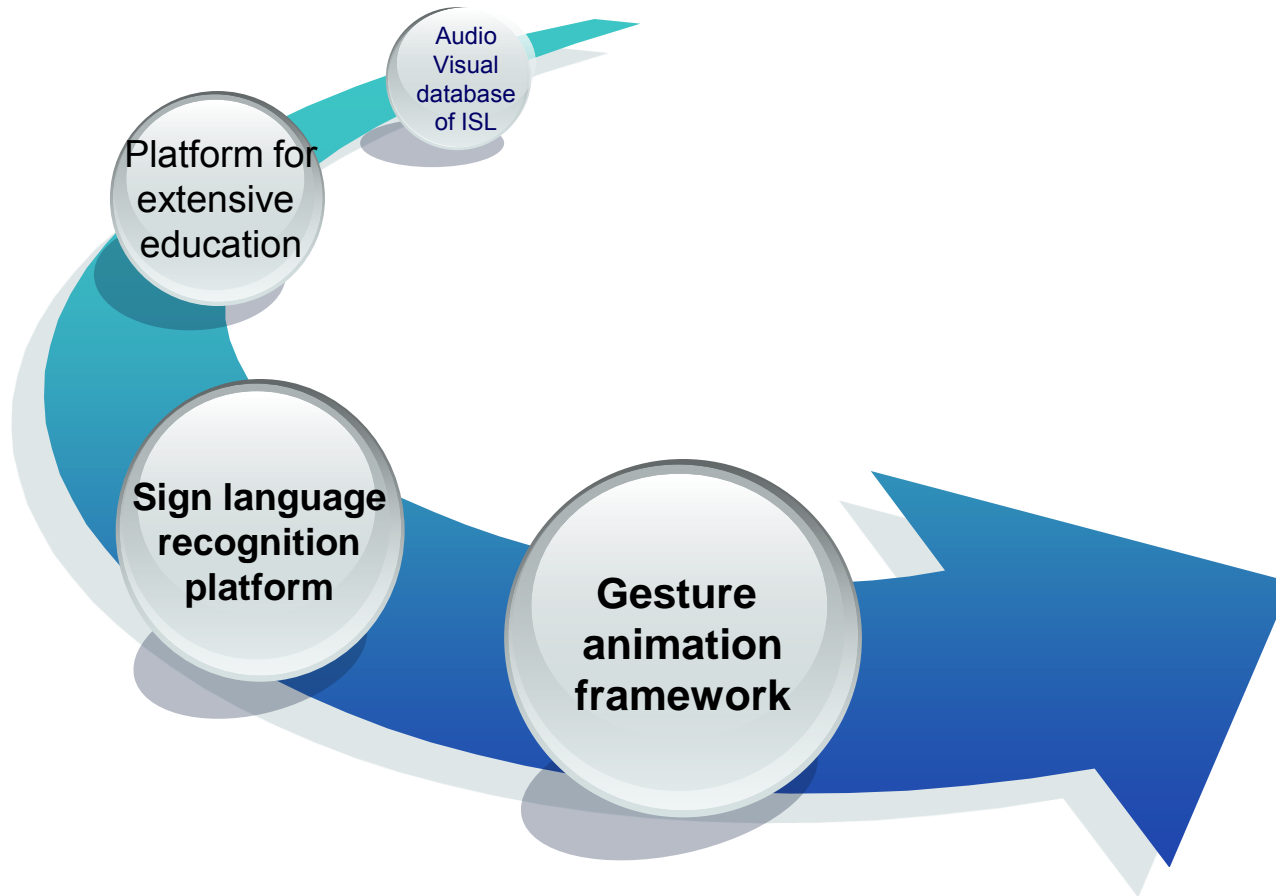
Goals



Project Goals and Scopes



Work Plan



Indian Sign Language Education & Recognition

Work Plan

```
graph TD; WP([Work Plan]) --> PP[Pilot Phase (Completed)]; WP --> MP[Main Phase];
```

Pilot Phase

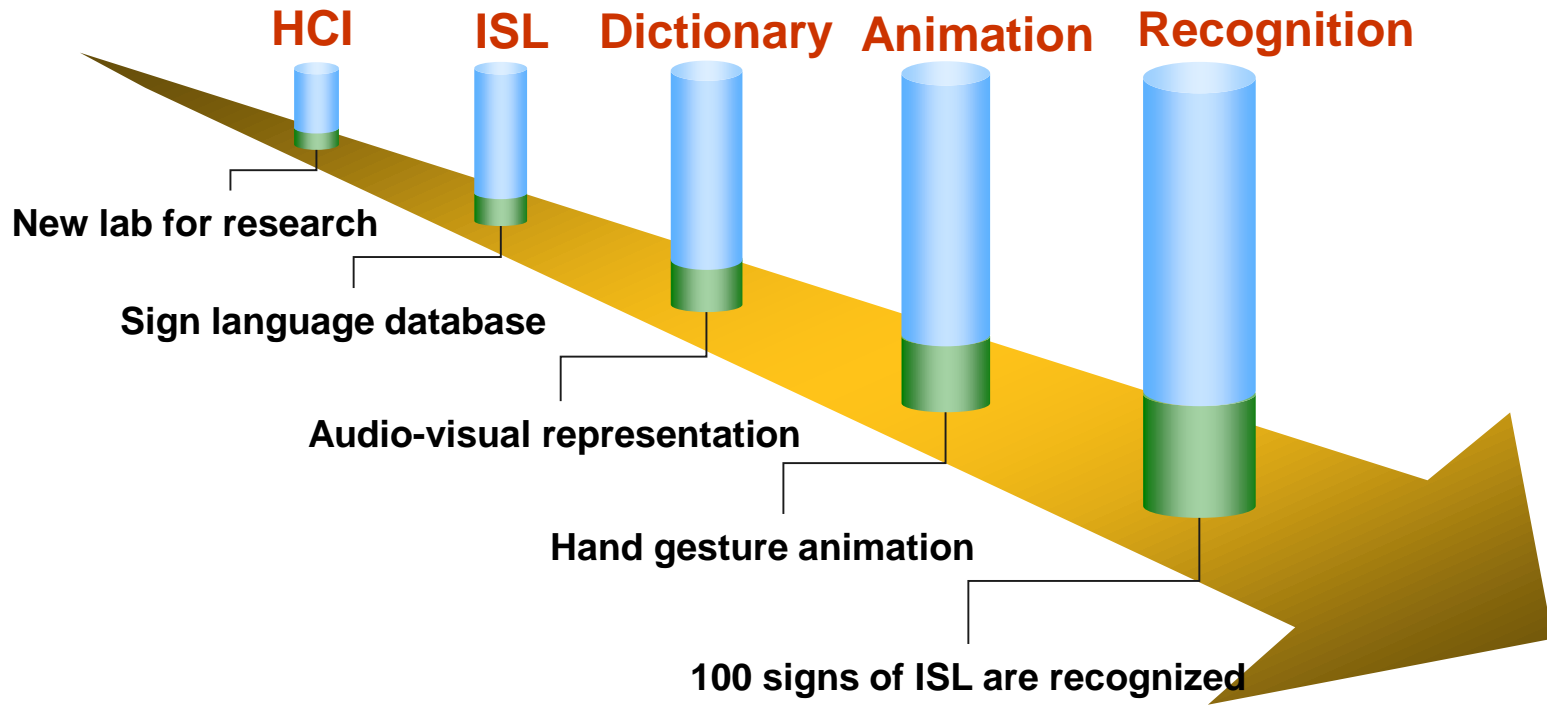
(Completed)

- Literature study of ISL
- Creation of an extensive database
- Audio/Video analysis
- Generalized platform for sign language education
- Recognition of hand gestures

Main Phase

- Development of full gesture recognition module
- Gesture animation system
- Building the prototype recognition system
- Extension related to Indian classical dance education

Work Accomplished



Indian Sign Language Education

Project Website

<http://www.iitg.ernet.in/isl/index.htm>

The screenshot shows a Mozilla Firefox browser window displaying the website for the Indian Sign Language Education & Recognition System. The browser's address bar shows the URL www.iitg.ernet.in/isl/index.htm. The website features a header with the national emblem of India and the motto 'सत्यमेव जयते'. The main title is 'Indian Sign Language Education & Recognition System', followed by the subtitle 'A project under National Mission On Education through ICT of Ministry of Human Resource and Development'. A navigation menu includes links for Home, About Sign Language, Plan Of Action, Implementation Team, and Reviewers of Project. Below the menu, there are sections for 'Workshop', 'Photogallery', 'Course', and 'Braille System'. The 'Workshop' section highlights an award received by Dr. M.K. Bhuyan, Principal Investigator, for his work on the project. The 'Course' section provides a brief overview of the project's goal to develop an automatic Indian Sign Language education and recognition platform. A 'Sign In' form is visible on the right, and a 'Learn Online' button is prominently displayed at the bottom right. The Windows taskbar at the bottom shows the system time as 7:27 PM on 5/26/2014.

Indian Sign Language - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Indian Sign Language

www.iitg.ernet.in/isl/index.htm

Ask Search

Indian Sign Language Education & Recognition System

A project under National Mission On Education
through ICT of Ministry of Human Resource and Development

सत्यमेव जयते

Home
About The Project
Mission Document

About Sign Language
Indian Sign Language
Event

Plan Of Action
Work Accomplished
Future Enhancements

Implementation Team
Feedback
Research Publication

Reviewers of Project
Work Plan
Snap of Equipments

Workshop Photogallery Course Braille System

Welcome to Indian Sign Language Education & Recognition System

AWARDS AND HONOURS

NEW USER REGISTER HERE

Sign In

User name

Email

Sign in

Learn Online

Dr. M.K. Bhuyan, Principal Investigator of the project has been awarded National Award for his

This project is aimed to develop an automatic Indian Sign Language education and recognition platform for hearing impaired students of India. The system can substantially help in the primary/vocational/higher education of hearing impaired students and people of India. The framework is proposed to be extended to 14 different languages of India with extensive interactive features in the audio-visual mode.

Another important aspect of the project is that, the proposed interactive system will be able to recognize different hand/body gestures of Indian Sign Language

Indian Sign Langu... Presentation Project_Report_27...

7:27 PM 5/26/2014



Indian Sign Language Education & Recognition System

A project under National Mission On Education
through ICT of Ministry of Human Resource and Development

- Home About The Project Mission Document
- About Sign Language Indian Sign Language Event
- Plan Of Action Work Accomplished Future Enhancements
- Implementation Team Feedback Research Publication
- Reviewers of Project Work Plan Snap of Equipments

Contact

Welcome to Indian Sign Language Education & Recognition Sy

Expression Of Interest...
indian sign Language Education & Recognition System.

- Research Publications Related to The Project
- List of Reviewers of the Project
- Snap of Different Equipments used in the Project



Existing User Login Here

New User Registration

Please enter user name and email id properly.
These two will be required at the time of user log in phase

User Name
Occupation
Gender
Email id



Refresh Image

submit

Live Traffic Feed



- A visitor from Guwahati, Assam viewed 'Indian Sign Language' 0 secs ago
- A visitor from Guwahati, Assam viewed 'Indian Sign Language' 1 day ago
- A visitor from Calcutta, West Bengal viewed 'Indian Sign Language' 1 day 16 hours ago
- A visitor from Guwahati, Assam viewed 'Indian Sign Language' 1 day 16 hours ago
- A visitor from Calcutta, West Bengal viewed 'Indian Sign Language' 1 day 19 hours ago
- A visitor from Delhi viewed 'Indian Sign Language' 1 day 20 hours ago

Real-time View - Menu

World Mobile Tech
wireless technology from around the world, content & products added daily.



Indian Sign Language Education & Recognition System

A project under National Mission On Education
 through ICT of Ministry of Human Resource and Development

- Home
- About The Project
- Mission Document
- About Sign Language
- Indian Sign Language
- Event
- Plan Of Action
- Work Accomplished
- Future Enhancements
- Implementation Team
- Feedback
- Research Publication
- Reviewers of Project
- Work Plan
- Snap of Equipments

Workshop Photogallery Course Braille System Welcome to Indian Sign Language Education & Recognition System



AWARDS AND HONOURS

Dr. M.K. Bhuyan, Principal Investigator of the project has been awarded National Award for his research contribution on Indian Sign Language Education related

[View More](#)

Expression Of Interest...

active participation contribution to the development of Indian Sign Language Education & Recognition System.

Review

[NEW USER REGISTER HERE](#)

Sign In

User name
 Email

Learn Online

Photo Gallery



[Go to gallery](#)

Live Traffic Feed



This project is aimed to develop an automatic Indian Sign Language education and recognition platform for hearing impaired students of India. The system can substantially help in the primary/vocational/higher education of hearing impaired students and people of India. The framework is proposed to be extended to 14 different languages of India with extensive interactive features in the audio-visual mode.

Another important aspect of the project is that, the proposed interactive system will be able to recognize different hand/body gestures of Indian Sign Language and the system can give the interpretation of the recognized gestures in the form of some text messages displayed in the computer monitor along with audio interpretation. [Read More](#)

Feedback

Yuji Iwahori, Professor, Dept. of computer Science, Chubu University, Japan

Pragmatic approach to implement the system.

Tomohiro Morakomi Inspec Inc., Japan

Contact



सत्यमेव जयते

Indian Sign Language Education & Recognition System

A project under National Mission On Education
through ICT of Ministry of Human Resource and Development

Home
About The Project
Mission Document

About Sign Language
Indian Sign Language
Event

Plan Of Action
Work Accomplished
Future Enhancements

Implementation Team
Feedback
Research Publication

Reviewers of Project
Work Plan
Snap of Equipments

Contact

Login as sign Logout

Word Level Category

- ▶ Alphabets
- ▶ Art , Entertainment
- ▶ Audio Visual Equipments
- ▶ Behaviour Norms
- ▶ Beverages
- ▶ Body Parts , Functions
- ▶ Calendar Items
- ▶ Cities And Towns
- ▶ Continents , Countries
- ▶ Direction
- ▶ Dishes And Spices
- ▶ Domestic Animals, Birds
- ▶ Dressware , Cosmetics
- ▶ Educational Terms
- ▶ Family And Relations
- ▶ Festivals
- ▶ Fruits
- ▶ Games , Sports



This site is aimed to develop an automatic Indian Sign Language Education and Recognition Platform for hearing impaired students of India. It also offers a way of the teaching and learning of the Indian sign language

Gesture Recognition Level

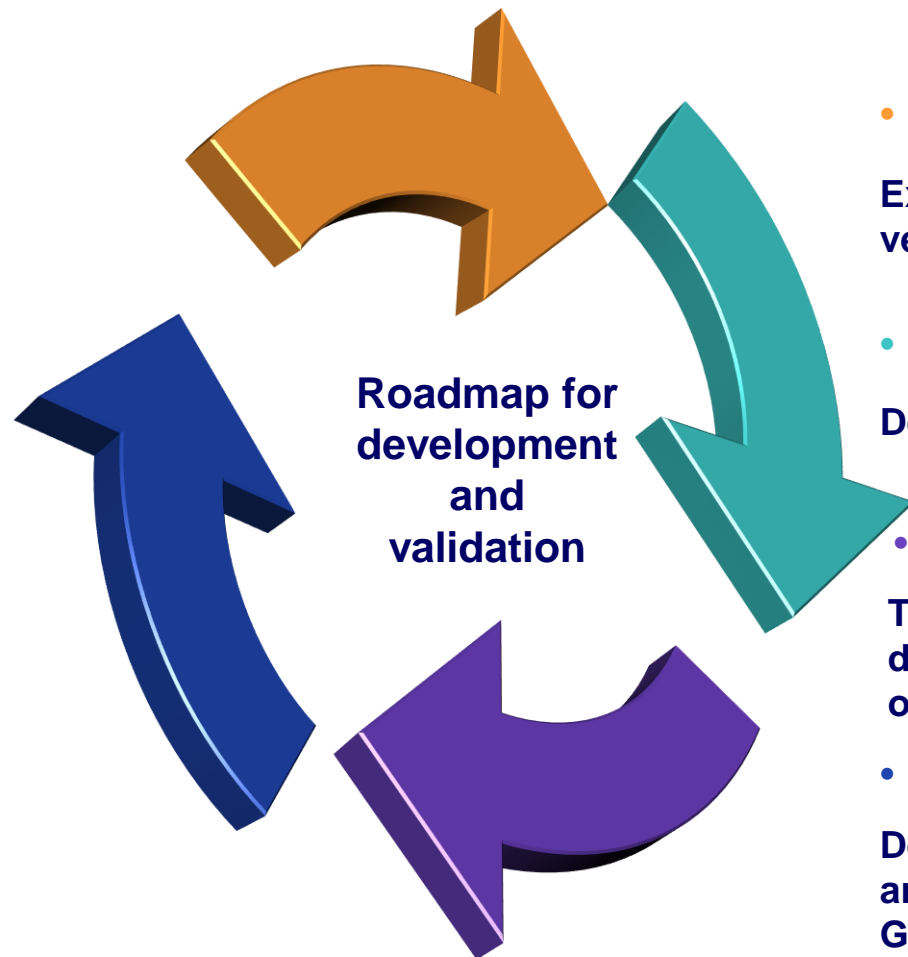
Review Recognition Phase...

- ▶▶ Fingertip Detection
 - ▶▶ Two Handed Fingertip Detection
 - ▶▶ Gestures having global motions used in the Project
- [view gallery...](#)

Sentence Level Category

- ▶ Interrogative Sentence
- ▶ Negative Sentence
- ▶ Adjective Sentence

Indian Sign Language Recognition System



- **Fundamental Research**

Extensive research for the development of a versatile Human Computer Interface.

- **Building Commercial Prototype**

Development of a prototype system for testing.

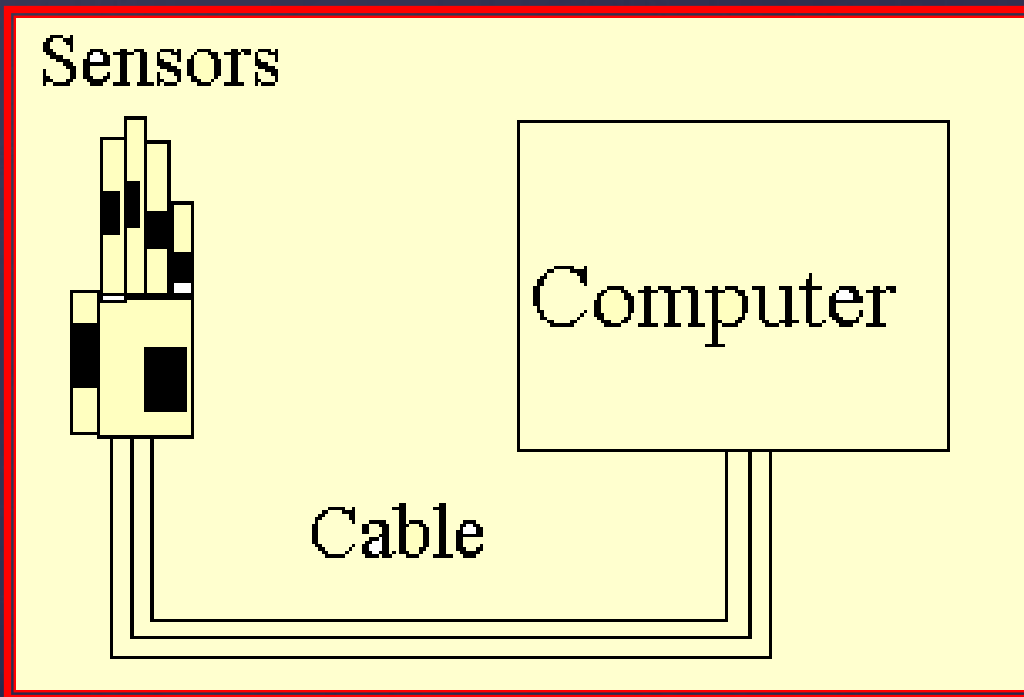
- **Testing of the system**

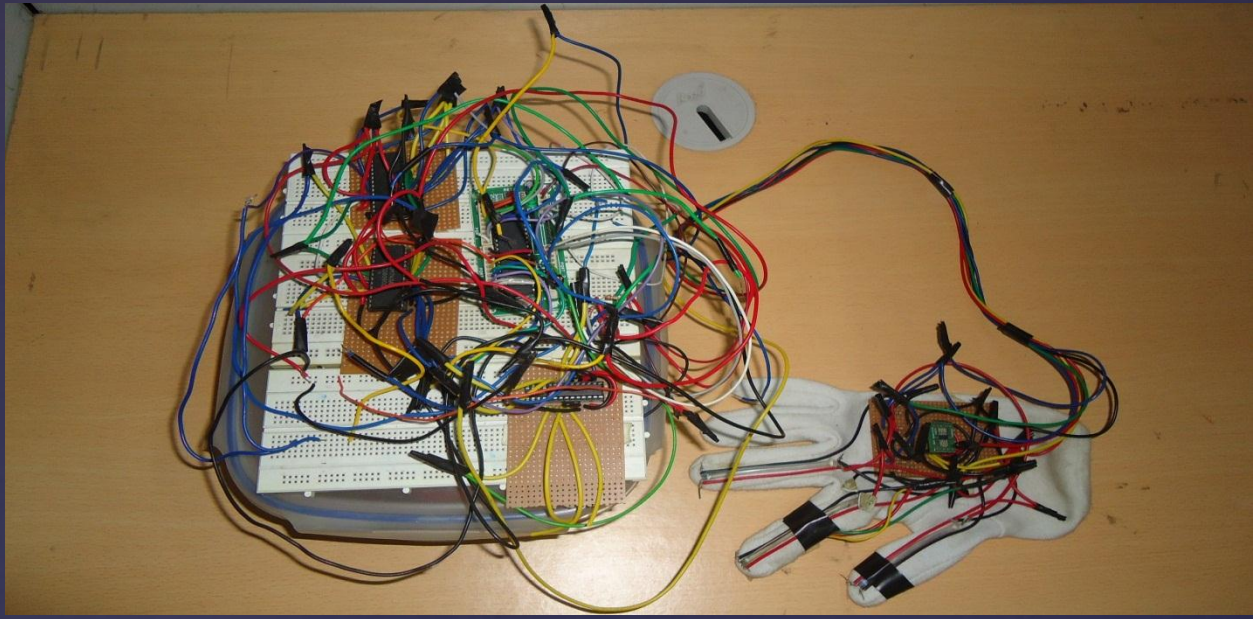
Testing of the proposed system by deaf and dumb students and subsequent improvement of the system.

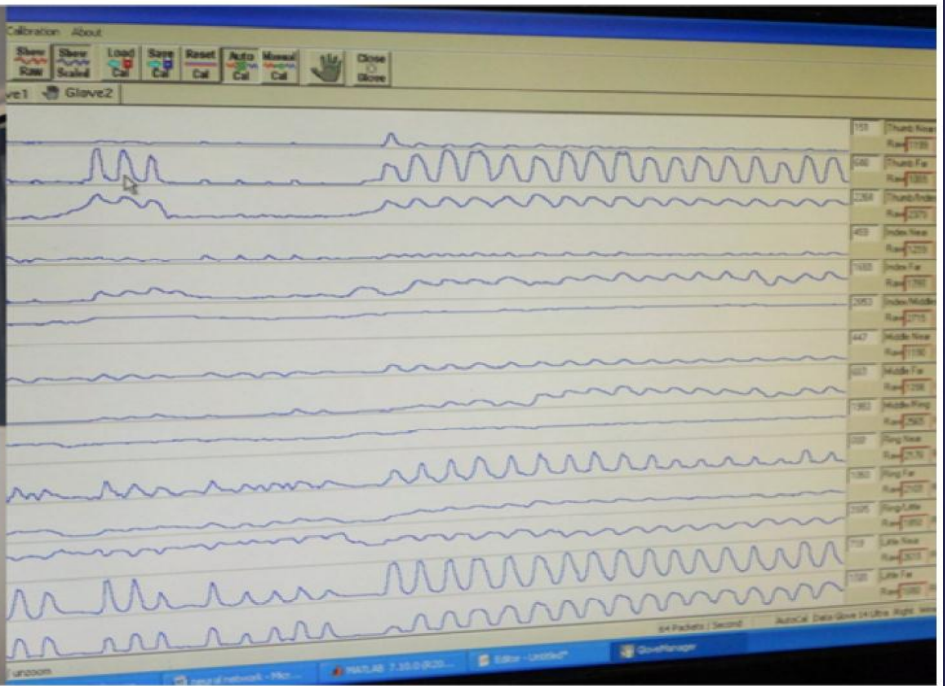
- **Deployment**

Deployment in deaf and dumb institutes of India and handing over the complete setup to MHRD, Government of India for possible deployment and commercialization.

Data Gloves

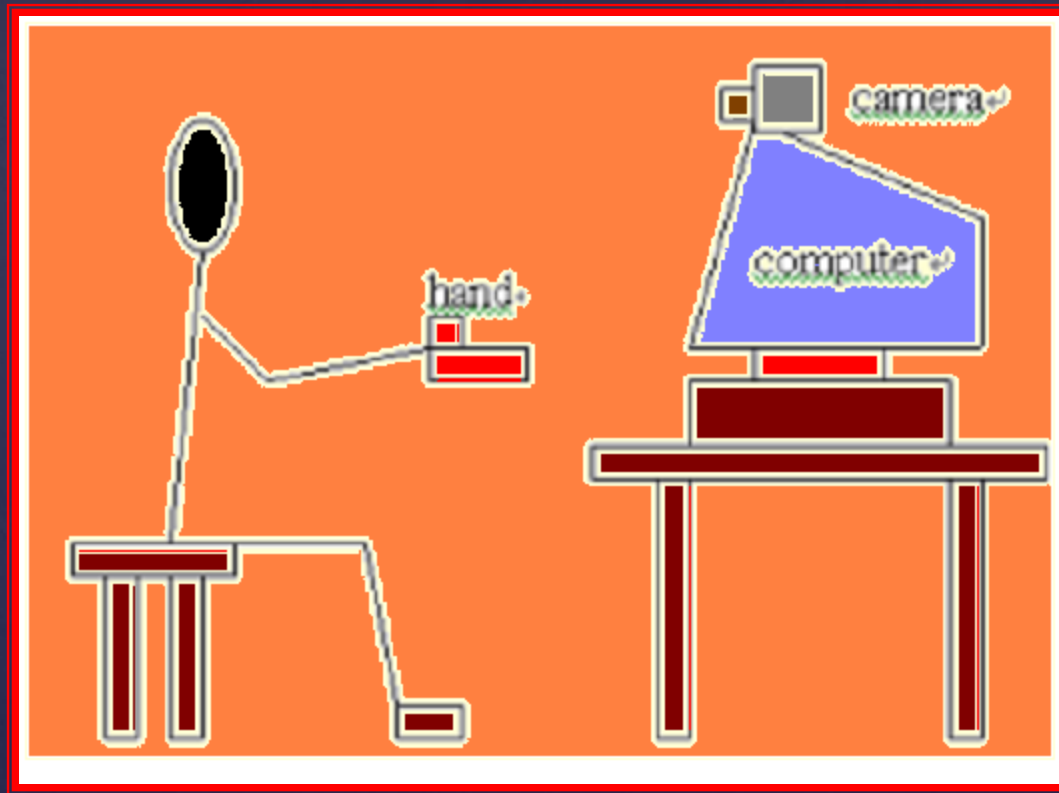






- Vision-based System

Wireless and Flexible
Usually Single Camera





A



B



C



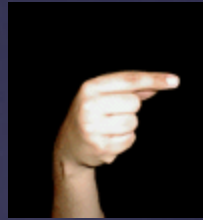
D



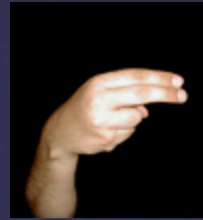
E



F



G



H



I



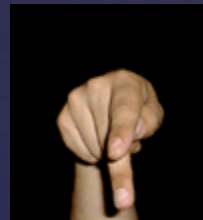
K



L



M



P



S



Y

Some Static Gestures (ASL)

<http://where.com/scott.net/asl/abc.html>



Chair



He has lost it



Open the door



He has forgotten it



Listen to it

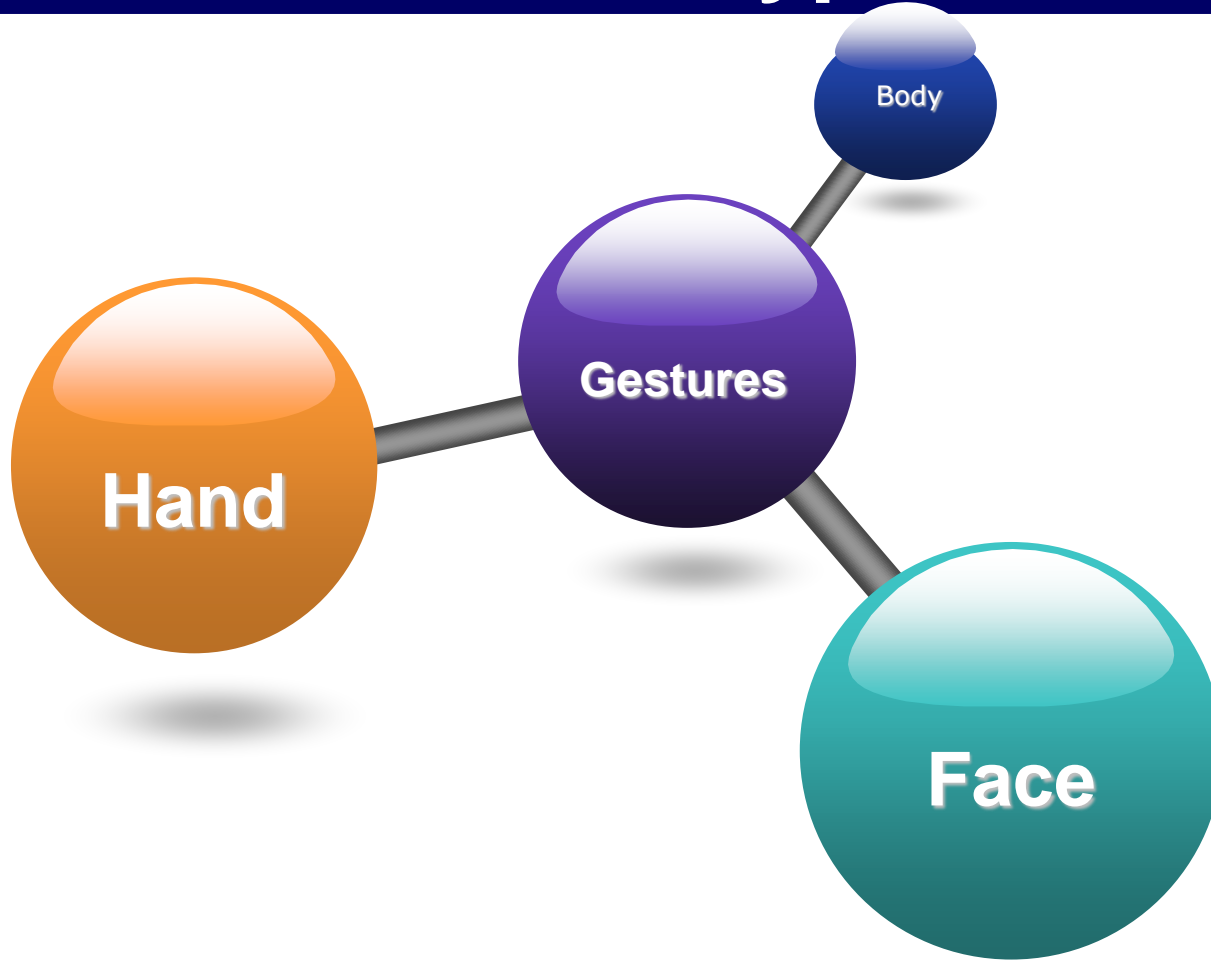


Throw it away

Dynamic Gestures

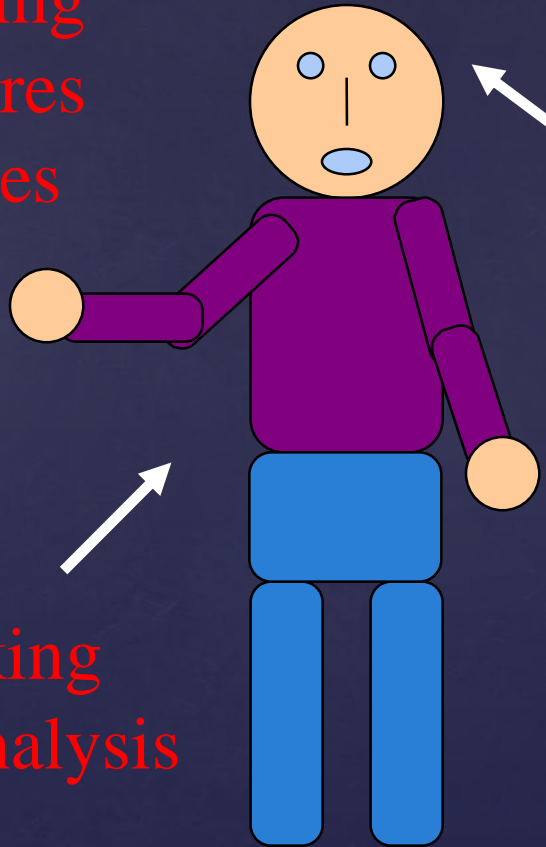
<http://www.comanchelodge.com/sign-language.html>

Gesture Types



Elements of Vision-based Interface (VBI)

Hand tracking
Hand gestures
Arm gestures

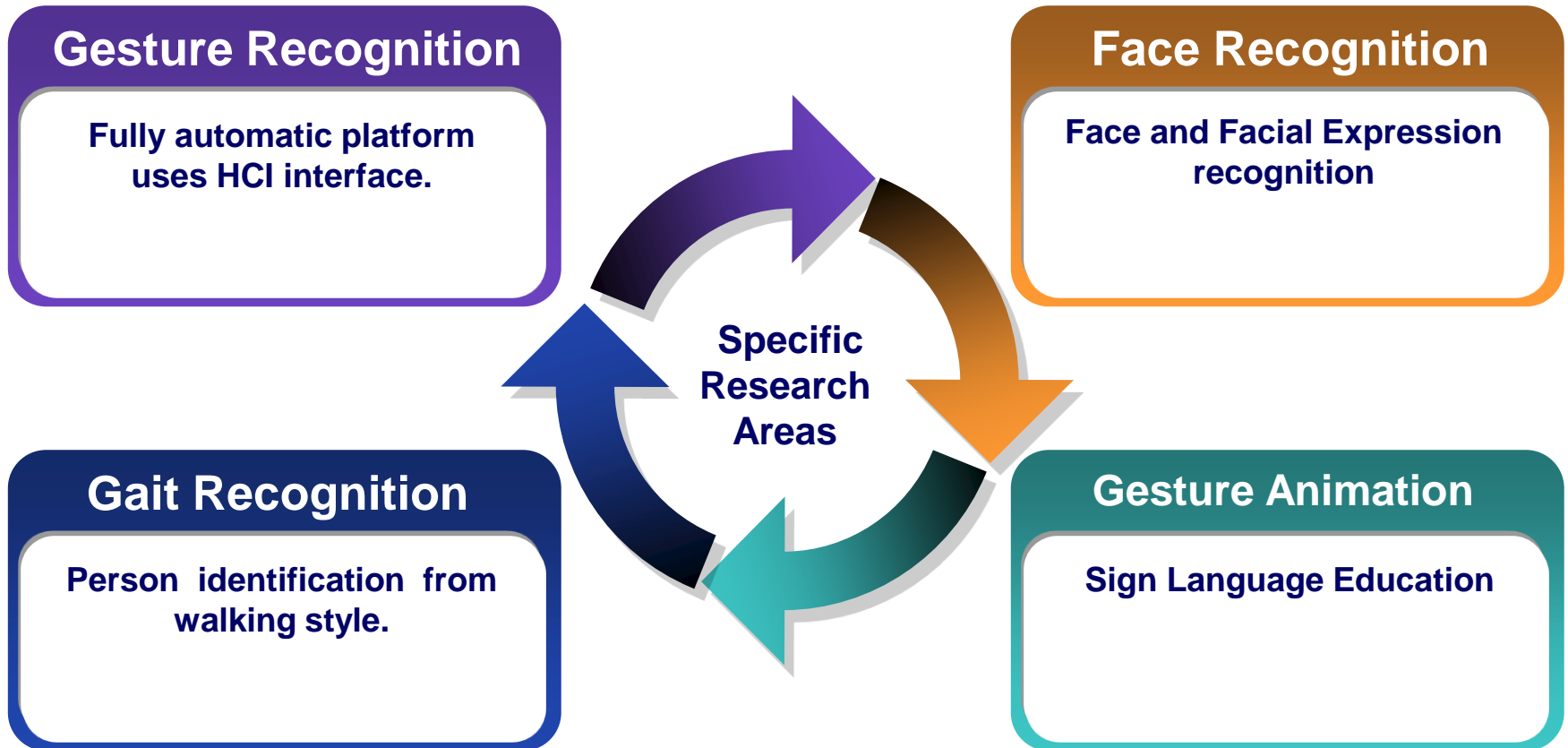


Body tracking
Activity analysis



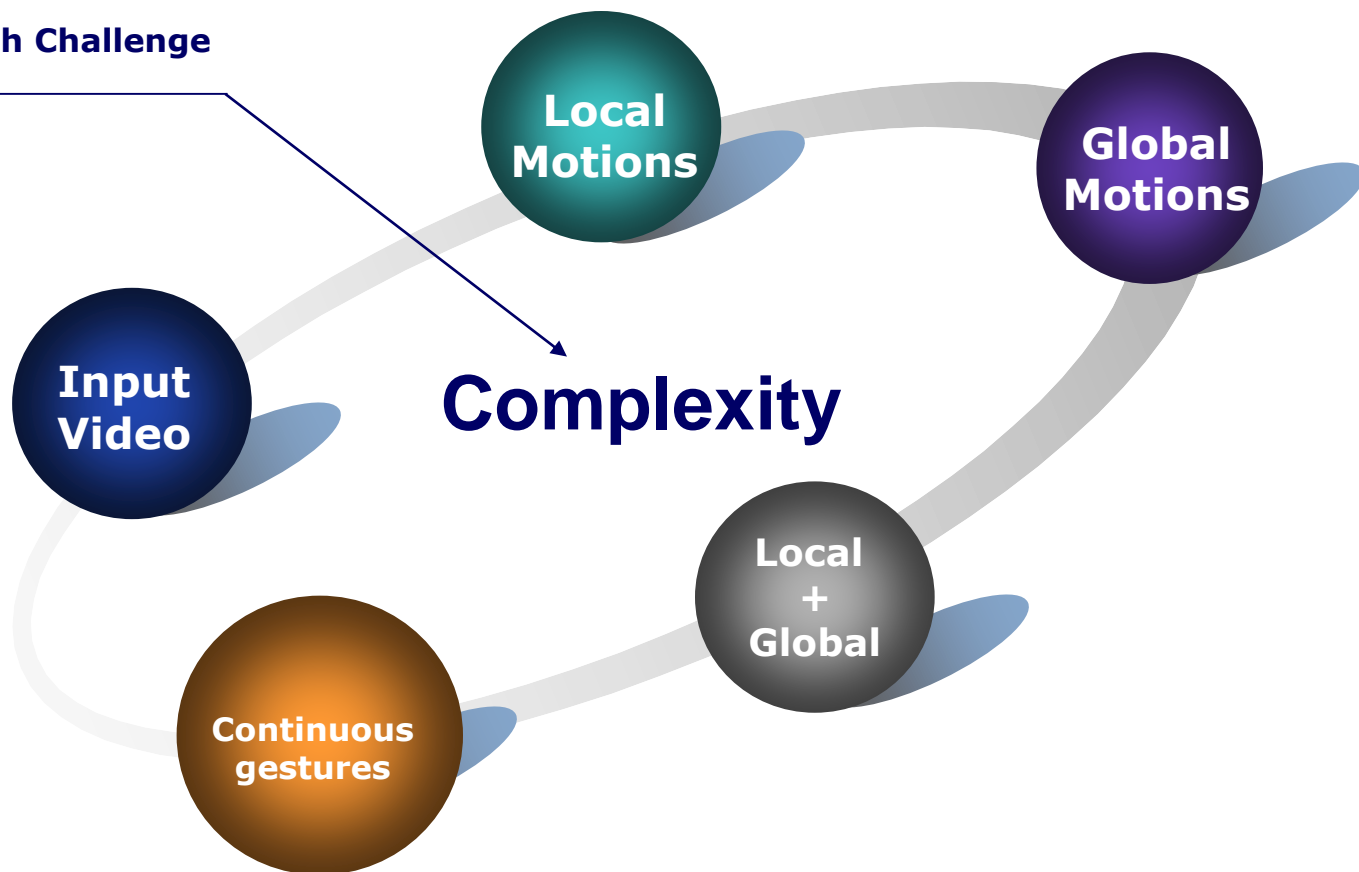
Head tracking
Gaze tracking
Lip reading
Facial expression

Specific Research Areas for Sign Language Recognition



Gesture Recognition System

Research Challenge



Proposed Gesture Recognition System

Different Hand Motions



ALL motions

- Co-articulation
- Movement epenthesis
- 92.0 %

Integrated

- Gesture class identification
- FSM and/or Trajectory
- 94.1 %

Trajectory

- MPEG-7 based motion trajectory.
- Trajectory features matching.
- 95.6 %

FSM

- MPEG-4 based VOP extraction
- Key frame extraction & summarization
- 92.2 – 99.1 %

Proposed System

Image/Video Input

Input from the image sensors/image acquisition.

Hand Segmentation

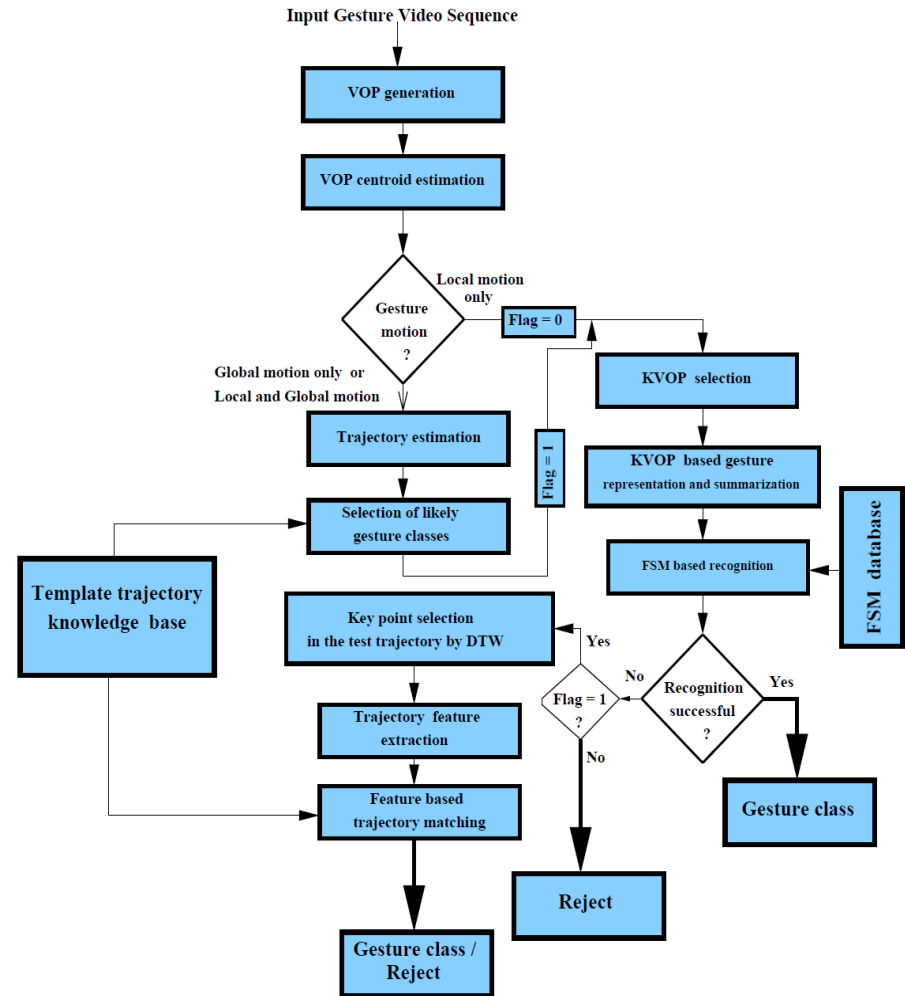
Object-based video abstraction (MPEG-4)

KEY frame extraction

Shape comparison by Hausdorff distance.

Gesture Summarization Recognition

Final classification by FSM and Trajectory features.





सत्यमेव जयते

Indian Sign Language Education & Recognition System

A project under National Mission On Education
through ICT of Ministry of Human Resource and Development

- Home
- About Sign Language
- Plan Of Action
- Implementation Team
- Reviewers of Project
- About The Project
- Indian Sign Language
- Work Accomplished
- Feedback
- Work Plan
- Mission Document
- Event
- Future Enhancements
- Research Publication
- Snap of Equipments

Gesture Recognition Level

- Fingertip Detection [I]
- Fingertip Detection [II]
- Fingertip Detection [III]
- Two Handed Fingertip Detection [I]
- Two Handed Fingertip Detection [II]
- Gestures having global motions

Indian Sign Language Recognition System Two Hand Fingertip Detection (Part II)



Login as sign Logout

Expression Of Interest...

IIT Guwahati, India invites academicians, institutions for their active participation/contribution

Review ...

- Research Publications Related to The Project
- List of Reviewers of the Project
- Snap of Different Equipments used in the Project

Contact



सत्यमेव जयते

Indian Sign Language Education & Recognition System

A project under National Mission On Education
through ICT of Ministry of Human Resource and Development

- Home
- About Sign Language
- Plan Of Action
- Implementation Team
- Reviewers of Project
- About The Project
- Indian Sign Language
- Work Accomplished
- Feedback
- Work Plan
- Mission Document
- Event
- Future Enhancements
- Research Publication
- Snap of Equipments

Login as sign Logout

Gesture Recognition Level

- Fingertip Detection [I]
- Fingertip Detection [II]
- Fingertip Detection [III]
- Two Handed Fingertip Detection [I]
- Two Handed Fingertip Detection [II]
- Gestures having global motions

Indian Sign Language Recognition System Gestures Having Global Motion



Expression Of Interest...

IT Guwahati, India invites academicians, institutions for their active participation/contribution to the development of Indian Sign Language

Review ...

- Research Publications Related To The Project
- List of Reviewers of the Project
- Snap of Different Equipments used in the Project

Contact

4



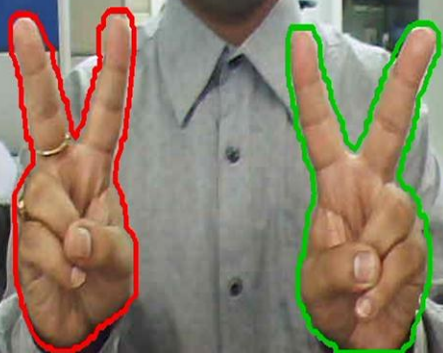
5

2

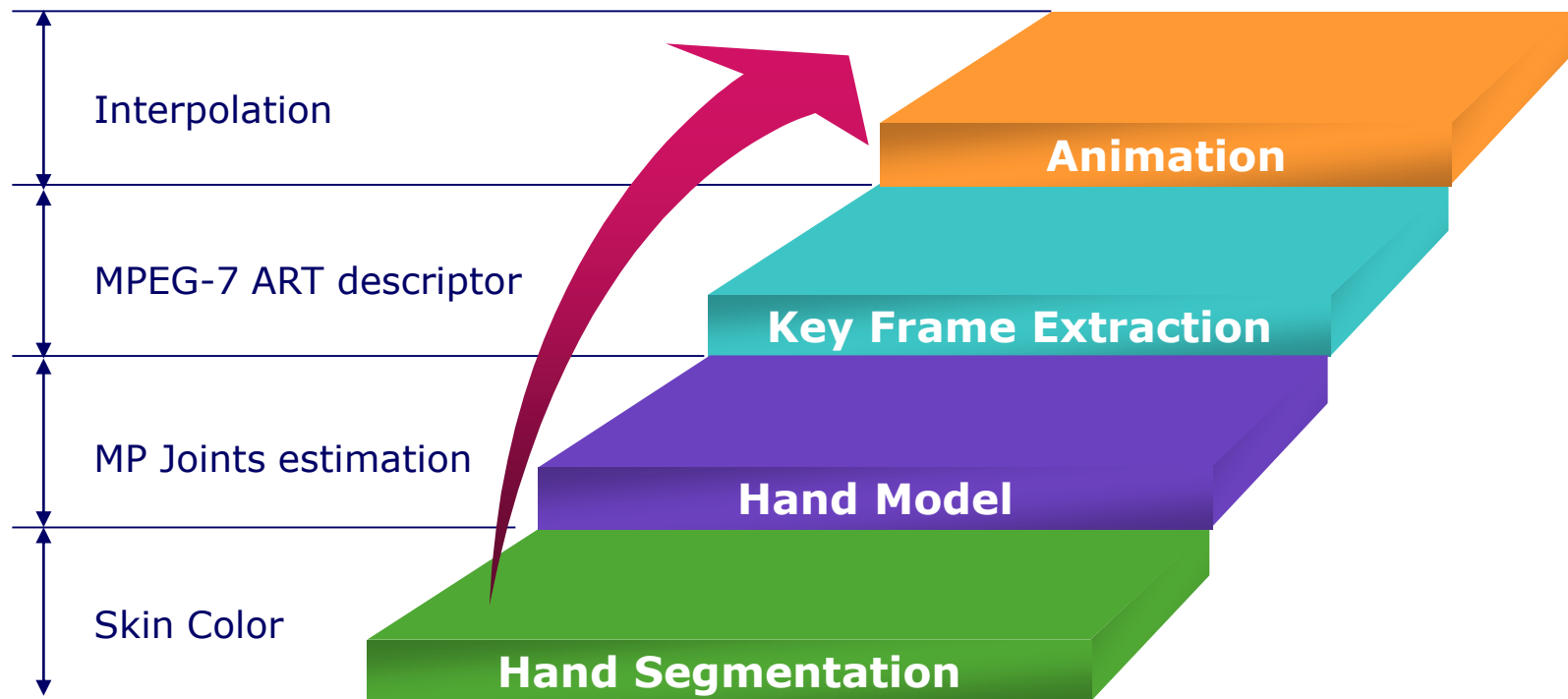


2

2



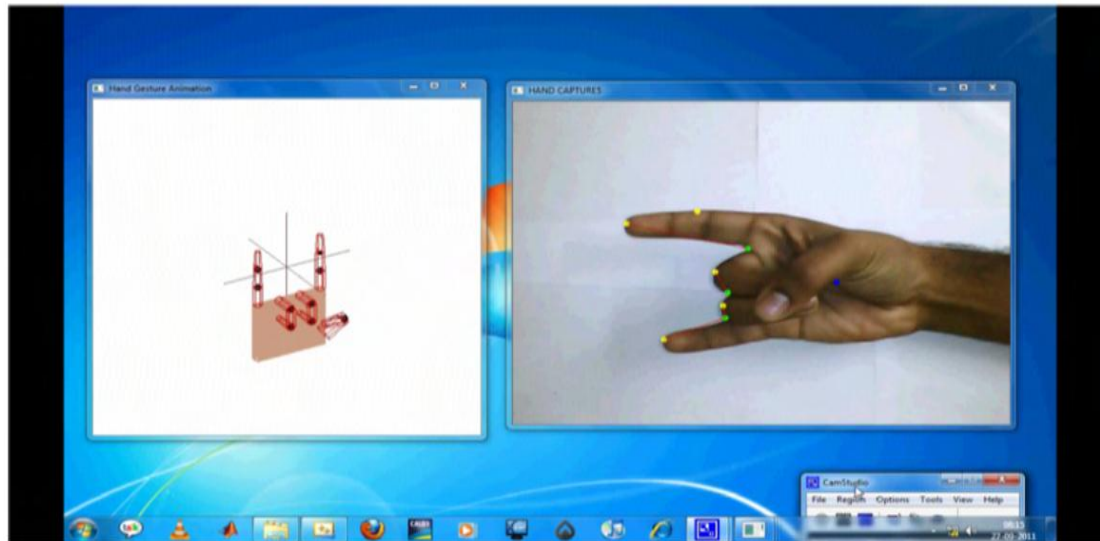
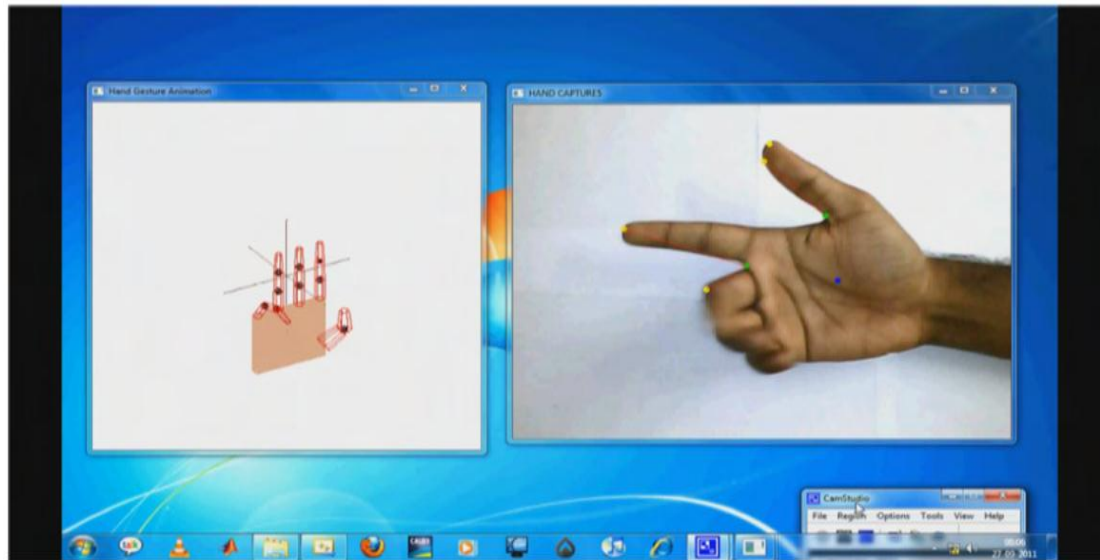
Hand Gesture Animation



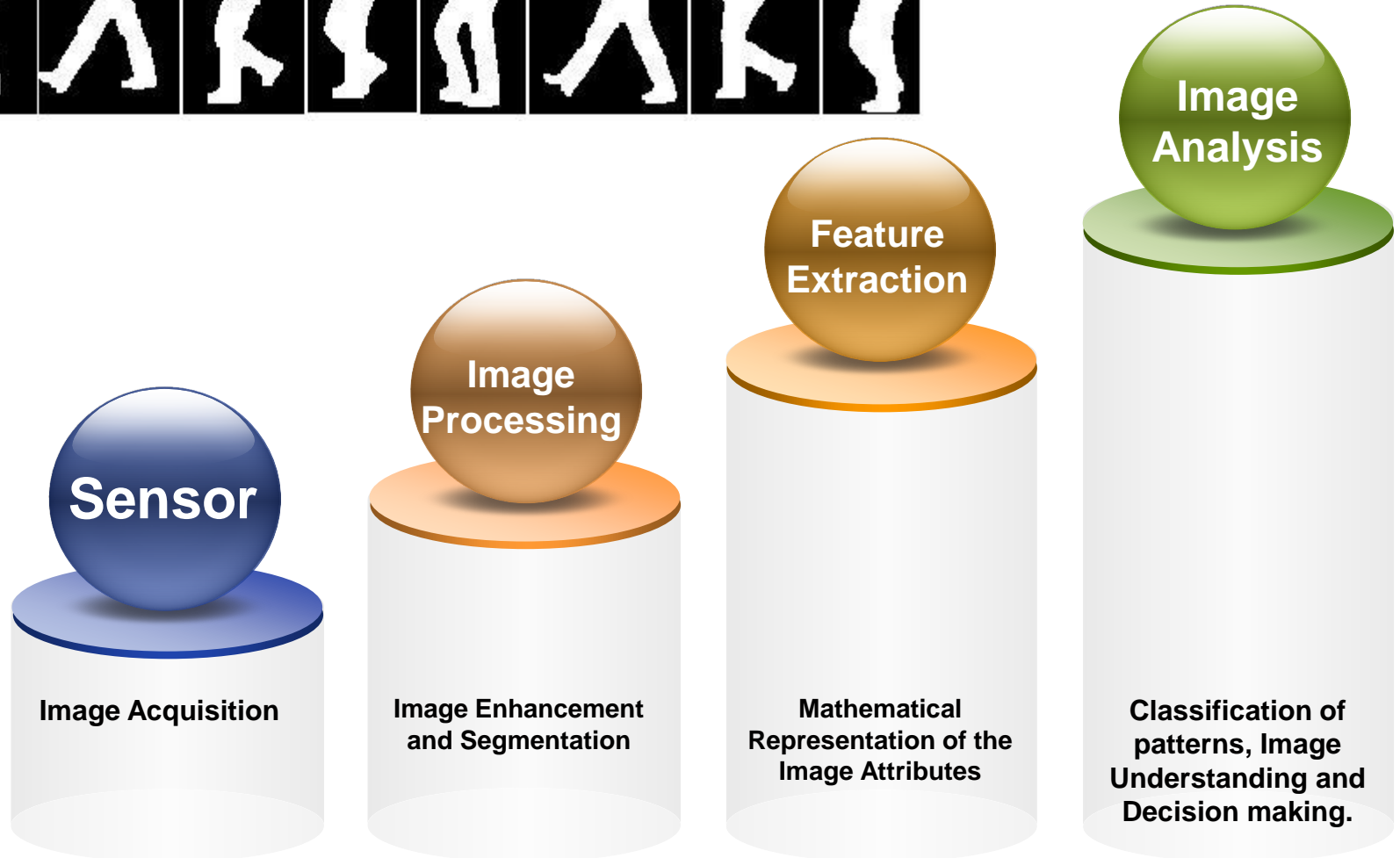
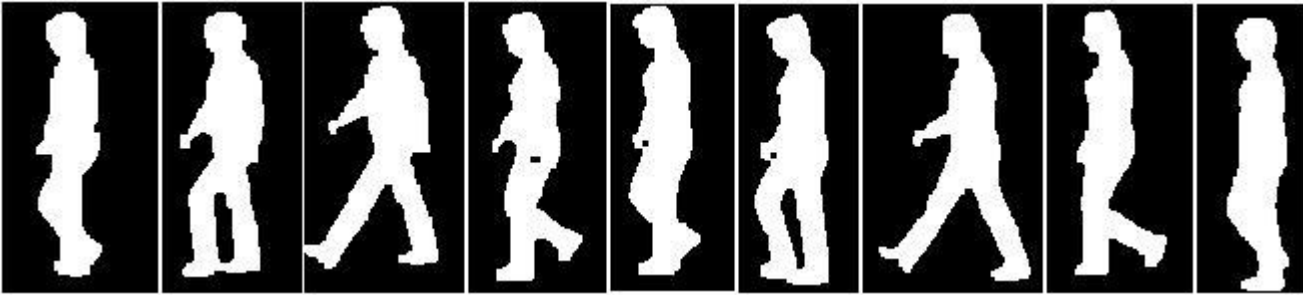
1. M.K. Bhuyan, V. Venkata Ramaraju and Yuji Iwahori , “Hand Gesture Recognition and Animation for Local Hand Motions”, accepted for publication in International Journal of Machine Learning and Cybernetics, Springer, 2013.

2. M.K. Bhuyan, Chaitanya Narra and Darsha Sharath Chandra, “Hand Gesture Animation by Key Frame Extraction’, Proceedings of IEEE International Conference on Image Information (ICIIP -2011), 2011, pp. 1-6.

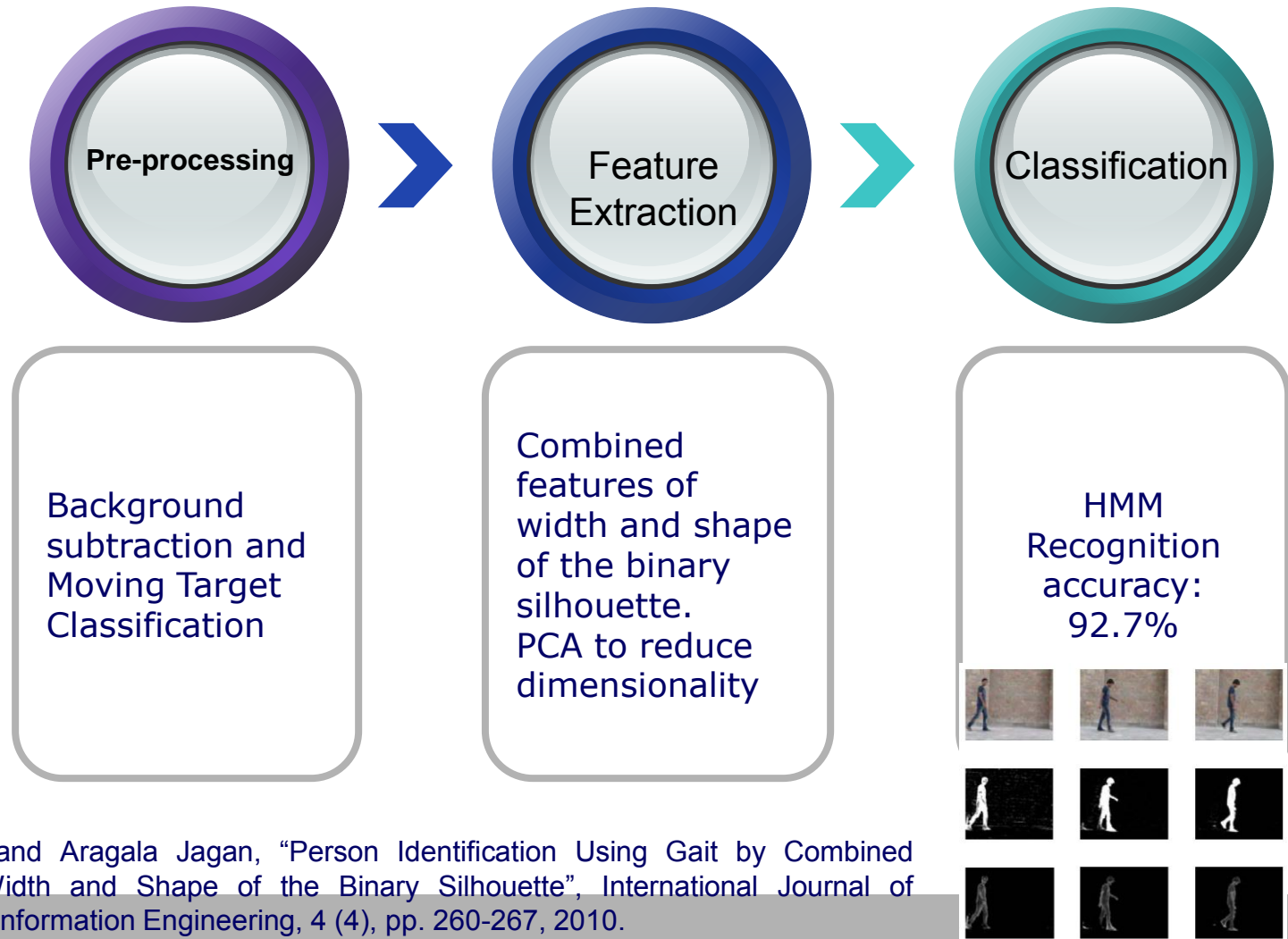
Hand Gesture Animation



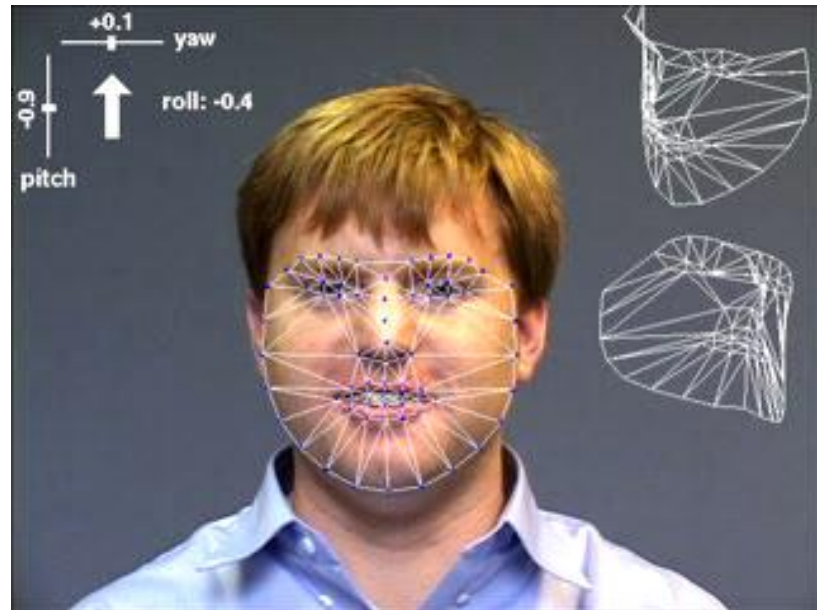
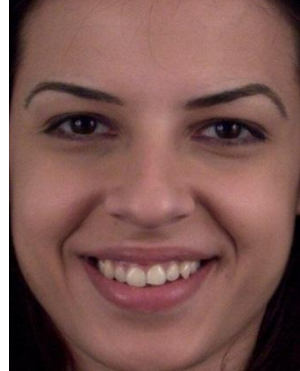
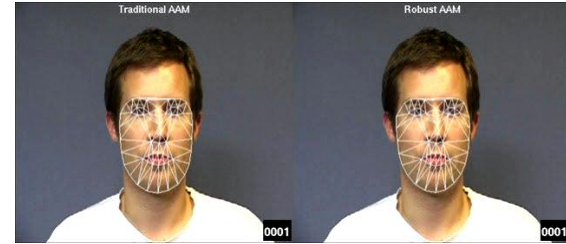
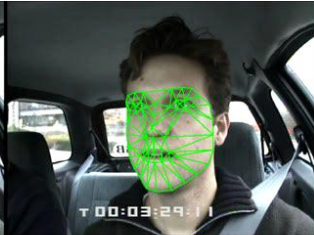
Gait Recognition



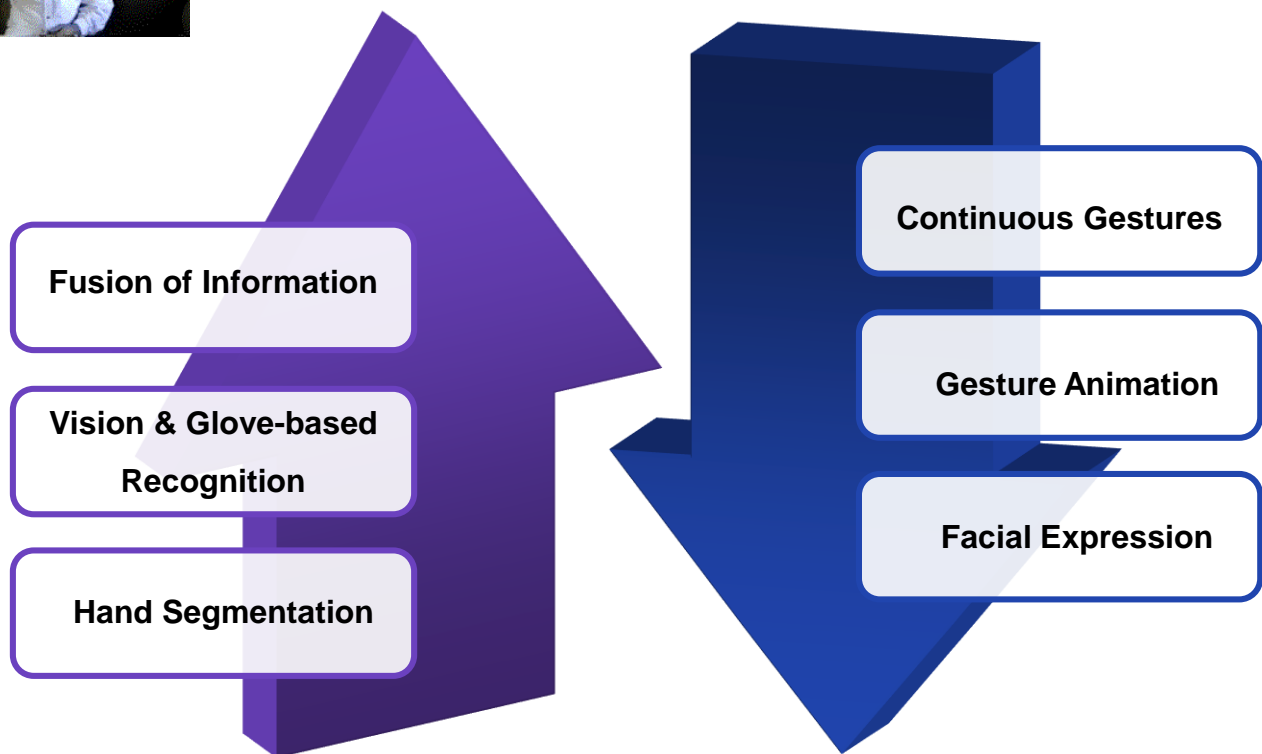
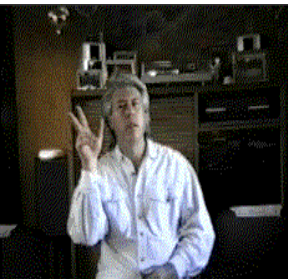
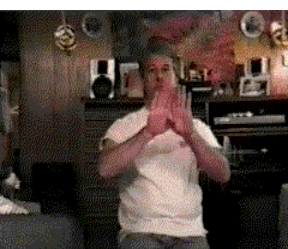
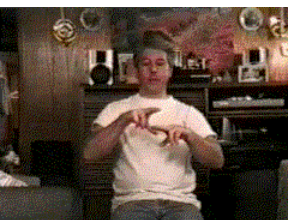
Proposed System



Facial Expression Recognition



Indian Sign Language Recognition System



Upward arrow: works already carried out
Downward arrow: works to be done.

Overall Development

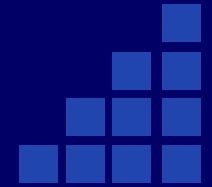
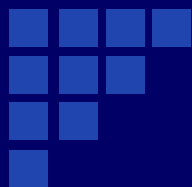


Indian Sign Language Education & Recognition System
Under National Mission Project
on Education through ICT, MHRD, Govt. of India.

Work Flow

2009 → 2010 → 2011 → **2015-17**





DEMO



Workshops Organized

- **Indian Institute of Technology, Guwahati, India**



Mr. Tomohire Morakomi, Inspec Inc., Japan
Dr. Yuji Iwahori, Professor, Chubu University, Japan
Dr. Arun Banik, Director, National Center for Disability Studies, IGNOU
Ms Indira Indira Ghosh (ISL Interpreter, AYINIHH, Kolkata)

- **National Institute for Hearing Handicapped, Kolkata, India**



Demonstration and Validation of the project

National Award for Best Applied Research and Innovation

I was awarded the National Award for "Best Applied Research/Technological Innovation" by Government of India. The award was conferred by **Honorable President of India** at Vigyan Bhawan, New Delhi on 6th February, 2013.




Demonstrating my interactive gestural sign language innovation at CET, IIT Guwahati, India.





List of publications related to the developed system:

1. **M.K. Bhuyan**, Debanga Raj Neog and Mithun Kumar Kar, "Fingertip Detection for Hand Pose Recognition", *International Journal of Computer Science and Engineering*, 4(3), ISSN: 0975-3397, pp. 501-511, March, 2012.
2. **M.K. Bhuyan**, "FSM-based Recognition of Dynamic Hand Gestures via Gesture Summarization Using Key Video Object Planes", *International Journal of Computer and Communication Engineering*, (6), pp. 248-259, 2012.
3. **M.K. Bhuyan**, D. Ghosh and P.K. Bora, "Recognition of Wide Classes of Continuous Hand Gestures for Human Computer Interaction", *International Journal of Pattern Recognition and Artificial Intelligence, World Scientific*, 25 (2), pp. 227-252, 2011.
4. **M.K. Bhuyan**, Mithun Kumar Kar and Debanga Raj Neog , "Hand Pose Identification From Monocular Image for Sign Language Recognition' ",*Proceedings of IEEE International Conference on Signal and Image Processing Applications (ICSIPA 2011)*, Malaysia, November 2011, pp. 378-383.
5. **M.K. Bhuyan**, Chaitanya Narra and Darsha Sharath Chandra, "Hand Gesture Animation by Key Frame Extraction', *Proceedings of IEEE International Conference on Image Information (ICIIP -2011)*, India, November 2011, pp. 1-6.
6. **M.K. Bhuyan**, Mithun Kumar Kar and Debanga Raj Neog, "Finger Tips Detection for Two-handed Gesture Recognition," *Proceedings of SPIE 8285, 828516 (2011)*.

- 
7. **M.K. Bhuyan**, Mithun Kumar Kar and Debanga Raj Neog, "Finger Tips Detection for Two-handed Gesture Recognition," *Proceedings of International IEEE Conference on Graphic and Image Processing (ICGIP 2010)*, Manila, Philippines, December 2010, pp. 4-9.
 - 8 **M.K. Bhuyan**, Debanga Raj Neog and Mithun Kumar Kar, "Hand Pose Recognition using Geometric Features ", *Proceedings of National Conference on Communication (NCC 2011)*, IISC Bangalore, pp.1-5.
 9. **M. K. Bhuyan**, "An Integrated Gesture Recognition Scheme for Human Computer Interactions", *Proceedings of the 12th National Conference on Communications (NCC 2009)*, IIT Guwahati, India, pp.1-4.
-
-

Current Financial Position

Amount sanctioned for the pilot phase: Rs. 132 Lakhs.

Amount received: Rs. 132 Lakhs

Total expenditure till date: Rs. 132 Lakhs

Balance amount: **NIL**

Over Expenditure: Rs. 39,437.00

Main phase project proposal was submitted on the standing committee meeting (16th July, 2011) and discussed on the standing/evaluation committee meeting (3rd Sept, 2011)

Budget proposed for the main phase: Rs. 426.41 Lakhs



Thank You !

Major Equipment to be Procured

