Hewlett-Packard Labs India
Inventing for HP's Next Billion Customers

HP Labs

Established in 1966, HP Labs has fueled HP's growth through technological inventions and innovations in printing, computing, and communications. HP Labs current focus is tackling complex challenges facing our customers and society. Collectively, we are applying our expertise to address five opportunities that we believe are crucial to defining the future of information technology

- Information explosion - Acquiring, analyzing and delivering the right information to individuals and businesses so they can act on it.
- Dynamic cloud services - Developing web platforms and cloud services that are dynamically personalized based on your location, preferences, calendar and communities.
- Content transformation - Enabling the fluid transformation of content from analog to digital, from device to device, and from digital content to physical products.
- Intelligent infrastructure - Designing smarter, more secure devices, networks and scalable architectures that work together to connect individuals and businesses to rich, dynamic content and services.
- Sustainability - Creating technologies, IT infrastructure and new business models for the lower carbon economy that save money and leave a lighter footprint on the environment.

HP Labs India

HP Labs India has been established with the principal focus on creating new technologies for addressing the IT needs of the next billion customers for HP. A large majority of these new customers arise from rapidly growing markets such as India. Effectiveness of IT has been limited in these markets due to issues related to IT complexity, affordability and infrastructure. At HP Labs India, we derive our inspiration by being deeply immersed in the local customer environment and understanding major global technology trends. HP Labs India works at the intersection of deep technical research, direct impact on HP's business and solving hard and significant customer challenges.

Research Project: Paper in the Digital Enterprise (PriDE)

Paper continues to exist in large volumes in spite of futuristic predictions of a 'paperless world'. It persists along the edges of a digital organization in communication between organizations and between organizations and their customers. The affable nature of paper makes it widely accepted, highly affordable, technology agnostic and unplugged. However, the disconnect between paper and digital systems leads to inefficiencies in small, medium and large enterprises.

The Paper in the Digital Enterprise (PriDE) project at HP Labs India aspires to create a unique and novel set of technologies to enable seamless co-existence of paper in a digital enterprise.

Our aim is to create new technologies for on-ramps, workflows and off-ramps in enterprises. The core technology concepts include the interpretation of handwritten annotations on documents, comparison and synchronization of changes from a paper document to its electronic counterpart, intelligent document image enhancement, new forms of machine readability that simplify the processing of paper documents and security of print workflows.

The main research threads in PriDE are:

- Intelligent Document Cleanup
- Paper as an Interface
- Paper Widgets
- Secure Print Workflows
- Comparison and Synchronization of content
- Semi-supervised classification of document images

The areas of research relevant to PriDE include:

- Document Image Analysis and Understanding
- Offline Handwriting Recognition
- Computer Vision
- Pattern Recognition
- Information theory
- Machine Learning
- Security related to Printing
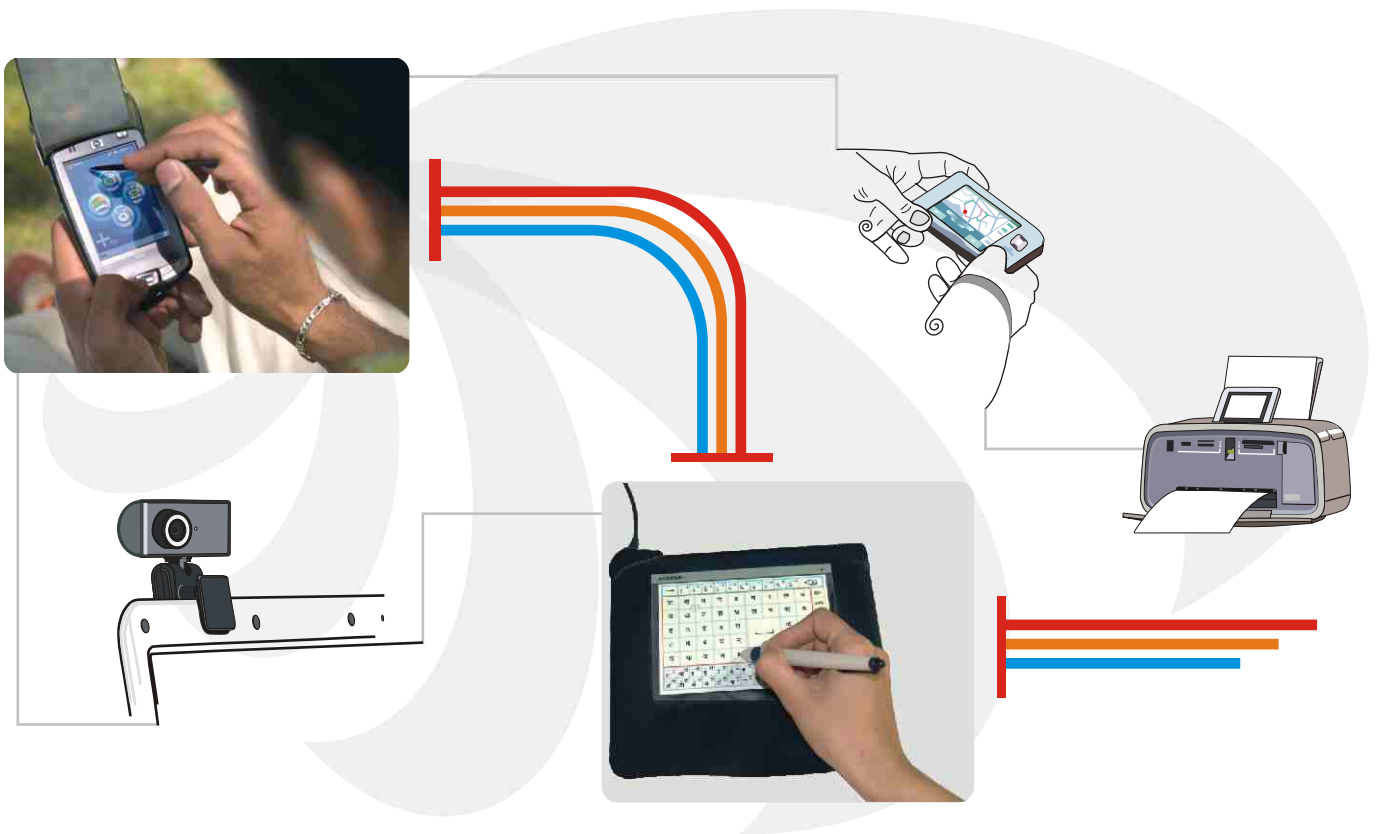
Research Project: Intuitive Multimodal and Gesture Interaction (IMaGIn)

The dexterous human hands have historically driven most input modalities for computer systems, including the dominant keyboard and mouse. However with the availability of additional sensors such as touch sensors and cameras, new, more natural input modalities such as pen, touch, and hand gestures are becoming mainstream and redefining human computer interfaces for personal systems.

The Intuitive Multimodal and Gestural Interaction (IMaGIn) project at HP Labs India explores new and compelling user experiences and supporting technologies for personal systems that are natural, context awareness, adapt with use and achieve multimodal integration.

Research at HP Labs aims to come up with solutions and architectures which fulfill the promise of optimizing functionality given the challenging constraints of embedded devices.

Our research threads include:

- Design of compelling human-computer interaction experiences
- Robust interpretation of pen, touch and visual hand gestures
- Awareness of user context using technologies such as face detection and recognition
- Multimodal integration and adaptation

This research will draw on new and existing techniques in the following areas

- Experience Design, User research and Ethnography
- Human Computer Interaction
- Image Processing and Computer Vision
- Pattern Recognition
- Sensor Fusion and Decision Combination

Some current activities include:

- FreePad, Eyes-free handwriting input
- Gesture Command and Control

Research Project: Simplifying Web Access for the Next Billion (SWAN)

In the emerging markets such as India there is tremendous excitement about World Wide Web. Use of the Internet for discovering relevant information, efficiently performing transactions and communication is valued even by the non-tech savvy users. However, the number of active Internet users in the country is much less than mobile phone users. A significant issue preventing web consumption today is the complexity of web tools. Each website imposes its own interaction metaphor. The user has to learn to use many such interfaces and express her needs in different ways across different web sites. In addition to this cognitive overload, non-availability of the web while on the move creates further barriers.

Simplifying Web Access for the Next billion (SWAN) project of HP Labs India aims to radically simplify web experiences and help everyone realize the value of the web. We believe web interaction should become as simple as using a phone, watching TV or reading a magazine or newspaper. User's web interactions need to be packaged so that the interaction is personally familiar, uncluttered and accessible with minimal effort.

The main research themes of SWAN are:

- Design of a platform where users can package their own personal web interaction patterns
- Compelling web interaction paradigms across multiple access devices and connectivity environments
- User Intent Determination to understand what the user wants to do

The core technologies used in this research include:

- Machine Learning
- Information Retrieval
- Semantic Web
- Mobility
- Web Mining
- Programming Language Design
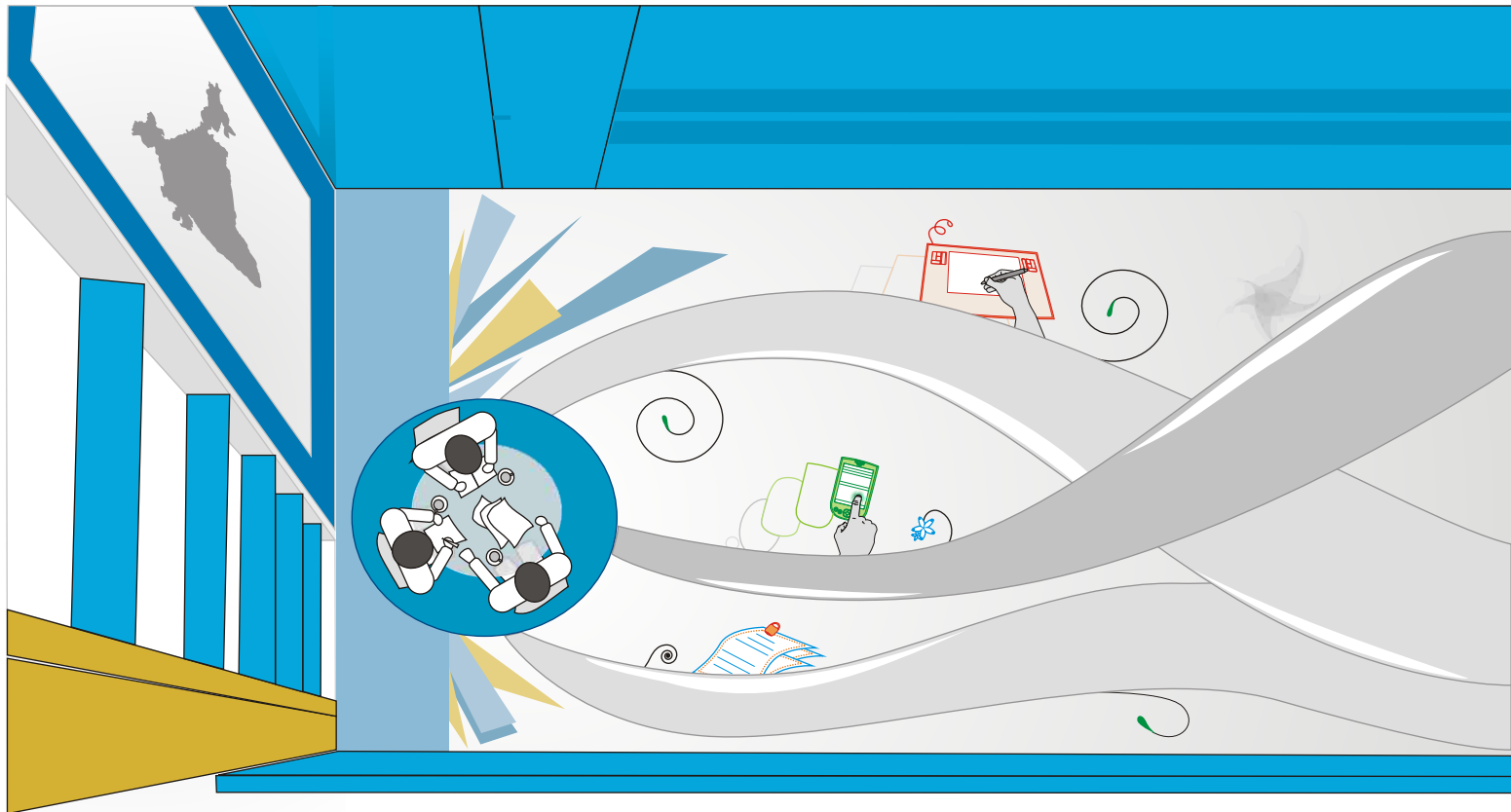
Research Project: Technology in Education (TiE)

Technology is playing an increasing role in education around the world. The vast community of educational institutions, teachers and even students are leaders in sharing the resources they create. They are also leaders in the Web 2.0 effort. The TiE effort carries out research aimed at creating new ideas and techniques for use by this e-Community and enhancing their effectiveness.

Our work includes mapping quizzes into competitive games, promoting student collaboration, and harvesting of educational content from student-student interactions. One of the platforms being used for this research is Moodle (www.moodle.org). Another platform being used is HP Educenter, a video-content capture system which feeds a digital library, for providing on-demand, on-campus access to rich media content. HP Educenter was developed at HP Labs India.

This effort is a collaboration between HP Labs India and the International Institute of Information Technology, Bangalore.

Our area of research covers the following questions

- How can we promote collaborative learning in student communities?
- How can we motivate and support students to work along the lines of Web 2.0 ideals, to create resources that will serve their own community?
- How can we identify the topics being discussed in a given item of text, without fitting it into a rigid classification system?
- Can we advance the art of educationally relevant "serious games"? Can we create middleware which will map quizzes into such games automatically?
- Can all these techniques work in a distance learning context as well, drawing upon geographically distributed contributors and serving geographically distributed users?
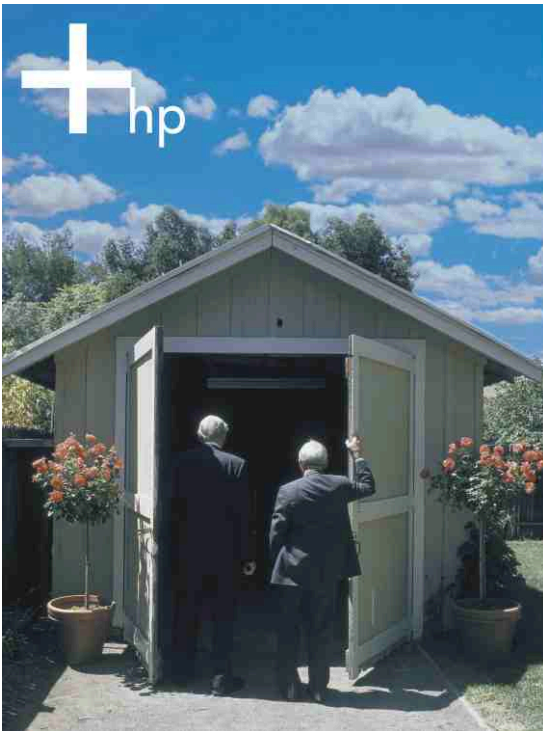
Careers and Open Innovation Office

At HP Labs "The future is not a dream; It will be invented." The primary focus is "inventing technologies for the next billion customers of HP." We are strongly motivated by a desire to transform our ideas into products that change the way we live and work.

HP Labs India provides a world-class research environment and offers challenging roles for people with technical depth and creativity who are willing to take risks. The work culture encourages and motivates teamwork, proactiveness, leadership abilities and helps uncover independent initiatives. Other highlights include a cordial and open work atmosphere that facilitates free flow of ideas.

Open Innovation Office

$$\left[\begin{array}{c} \textbf{HP Labs} \\ + \\ \textbf{Universities} \end{array} = \textbf{Open Innovation Office} \right]$$

HP Labs India has several engagements with the higher education community at the national and international level. Our collaborative work with these institutes takes the form of joint research projects as well as intern projects. The collaborations include joint PhD fellowships, sponsored research students and sponsored research projects.

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