Over the years…

docctors interacted with each other to get second opinion using the available communication technology

Invention of Telephone changed the way people lived!
Tele-ophthalmology

....breaking the distance barriers

• A system that electronically transports a consulting Physician from a medical center to a site at a distant facility where his/her expertise is required
Geography is History??
Why Tele-ophthalmology?

- Ophthalmic diseases are mostly diagnosed by viewing still images.
- Like in radiology, ophthalmology is apt for telemedicine.
Telemedicine levels of eye care delivery

- Primary eye care – Screening for common eye diseases
- Secondary
- Tertiary
In Primary eye care

• Rural internet kiosks
Internet kiosks

• Multiple internet kiosks have been started in remote villages.
• Have internet access through WLL (Wireless Local Loop)
• Run by the local person trained for this purpose
• Self sustaining
• Income generation
• Resource center – one of it, is the eye care service
Taking eye care to doorsteps…

n-Logue: Internet Kiosks

Kiosk operator sends patient information through mail

Public Internet

ISDN/POTS

Expert replies to the patient by mail
Taking eye care to doorsteps…
n-Logue: Internet Kiosks
Secondary Care

• Vision Centers
• Mobile screening unit
Aravind Vision Centres

1. Comprehensive primary eye care in rural area
2. Exploiting IT for rural eye care service delivery
3. Tele-consultation: Vision centre technician with ophthalmologists
4. Available on a permanent basis
5. Refraction and school screening
6. Community participation
Tele-consultation

Screened by paramedic at Vision Centre

Wireless connectivity @ 4mbps

Consultation by Ophthalmologist at Aravind Eye Hospital, Theni
Vision centres currently at:

Ambasumithram—April 2004
(10 KM from Theni)

Andipatti – Dec 2004
(7 KMs from Theni)

Bodinayakanur – Sep 14th
2005
(16 KMs from Theni)

Chinnamanur– March 20th
2006
(25 KMs from Theni)
Technology

WiFi 802.11b
Low cost
Unidirectional
antenna
Line of Sight
Upto 25Kms.
Innovation - Reducing the cost
Thinking out of the box
Designing equipment for the masses

Additional Investment:
- Cost of adapter rings: US$ 10 (about Rs. 500)
- Now this is used in village level Vision Centres

Investment for existing fundus camera
US$ 20,000 to 25,000 / Rs. 9 - 11 Lakhs
Eye Screening going mobile!!
Mobile Screening Van

- Goes to remote places
- Known diabetic pts. Are collected by the local physician
- Fundus images in a defined protocol are taken
- Recorded in a specialized software and transmitted to the Reading Grading Center at the Base Hospital
Then the system packs the images, (DICOM Standard) and the demographic details of the patient and uploads it to the central server through satellite.
Grading centre in the base hospital

Each set of images have set of questions based on ETDRS criteria
The reader can select a patient, look at each image one by one and record his observations in the system itself.

For ease of use, the images are loaded full screen in one monitor and the input forms are loaded in another monitor.
In the second monitor, the reader enters the inputs for grading. Lesions are predefined for each quadrant to track which fields are already graded. Standard Images for comparison are also available for reference.
• Standard images used for comparison as required.
• The standard images are displayed when the user clicks on the standard image thumbnail present in the grading screen.
Once all the images are graded, the system automatically generates a report with possible treatments, based on the observations made.

Reader can overwrite the diagnosis (if needed), add his comments and attach the critical images to be printed along with the final report.
Admin can add and maintain users

<table>
<thead>
<tr>
<th>Admin</th>
<th>Manage User -&gt; Add User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camps</td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td></td>
</tr>
<tr>
<td></td>
<td>User Id</td>
</tr>
<tr>
<td></td>
<td>User Name</td>
</tr>
<tr>
<td></td>
<td>Password</td>
</tr>
<tr>
<td></td>
<td>Email_Id</td>
</tr>
<tr>
<td></td>
<td>UserType</td>
</tr>
<tr>
<td>Client</td>
<td></td>
</tr>
<tr>
<td>Severity</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
</tr>
<tr>
<td>Followup</td>
<td></td>
</tr>
<tr>
<td>Lesions</td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Configuration</td>
</tr>
</tbody>
</table>

![Image showing user management interface](image-url)
Manage lesions
Map treatments

<table>
<thead>
<tr>
<th>Treatment Name</th>
<th>Treatment Desc</th>
<th>Default Checked</th>
<th>Type</th>
<th>Edit</th>
<th>Delete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focal Laser</td>
<td>Focal Laser</td>
<td>False</td>
<td>Eye specific</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>Pan Retinal Laser</td>
<td>Pan Retinal Laser</td>
<td>False</td>
<td>Eye specific</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>FFA</td>
<td>FFA Treatment</td>
<td>False</td>
<td>Eye specific</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>Optimize Medical Therapy of Glucose, BP, lipids</td>
<td>Optimised Medical Therapy</td>
<td>True</td>
<td>Common</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>Refer to an Ophthalmologist for Tertiary care</td>
<td>Refer to an Ophthalmologist for tertiary care</td>
<td>True</td>
<td>Common</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>Consider PRP for Patients with Type 2 DM</td>
<td>Consider PRP for patients with type 2DM</td>
<td>False</td>
<td>Eye specific</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>IHD Nephropathy</td>
<td>IHD Nephropathy</td>
<td>False</td>
<td>Eye specific</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>Urgent: Refer to an Ophthalmologist for tertiary care without delay</td>
<td>Urgent Refer to an Ophthalmologist for tertiary care without delay</td>
<td>True</td>
<td>Common</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>Complete bed rest, Restricted physical activity</td>
<td>Complete bed rest Restricted physical activity</td>
<td>True</td>
<td>Common</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>Surgery</td>
<td>Surgery</td>
<td>True</td>
<td>Eye specific</td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>FFA</td>
<td>FFA Treatment</td>
<td>False</td>
<td>Eye specific</td>
<td>Edit</td>
<td>Delete</td>
</tr>
</tbody>
</table>
We can generate reports about the status of cases and the diagnoses.
Client Provider

**Communication**

Client Application

- MS Access
- B C++

Provider Application

- SQL Server

**communication**

- B C++

**Archiving/ Dearchiving**

Provider Application

- ASP.NET
Images Captured in the mobile screening van

Sent to the Reading center through VSAT

Images Read and Graded using specialised software Called DRAGON (Diabetic Retinopathy Assessment and Grading Over Network)

Report regarding the severity level and further action is

Pt. counselled regarding further action suggested

Sent to the mobile van VSAT
Tele-ophthalmology Models elsewhere

Wilmer - Digiscope

• Ensure early intervention to screen for diabetic retinopathy – empowers primary care physician

  **Digiscope – Wilmer-EyeTel Innovation**

• Images captured by Digiscope transmitted over Internet to the Reading & Grading Centre, Wilmer
In Tertiary care

• Two Modes used in Consultation
  – Real time or Interactive Videoconferencing
  – Store & Forward
Experts at Madurai giving his opinion to a patient examined at a different hospital – Real Time over Videoconference
Store and forward technology

Web Based

Public Internet

ISDN/POTS

ISDN/POTS

Expert replies to the doctor by mail

Doctor sends patient information through mail
Store & Forward Mode

- Compiled medical data is stored and transmitted to another site for review.
- Rate of transmission is slower, not done in a live interactive way.
- A structured software to capture and maintain patient data for subsequent consultations / reference.
eyesTalk...a store & forward software...

- Developed here
- Allows general ophthalmologists to access speciality care
- Uses e-mail
- Client and Provider
### General Informations

**Presenting Complaint:** Def Vn BE 1 Month Known as DM 1 Yr on Rx.

### Visual Acuity

<table>
<thead>
<tr>
<th>Vision</th>
<th>Right Eye</th>
<th>Left Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un-Aided</td>
<td>6/36</td>
<td>6/60</td>
</tr>
<tr>
<td>Aided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pinhole</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Intra Ocular Pressure

<table>
<thead>
<tr>
<th>Method</th>
<th>Right Eye</th>
<th>Left Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schiotz</td>
<td>12.2 mm Hg</td>
<td>12.2 mm Hg</td>
</tr>
<tr>
<td>Applanation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Contact</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Signs

<table>
<thead>
<tr>
<th></th>
<th>Right Eye</th>
<th>Left Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lid and Adnexa</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>Conjunctiva</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
</tbody>
</table>

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**AEH Madurai:** (7/18/2006 12:40)

RE-MOD NPDR LE-SEVERE NPDR WITH MACULAR ISCHAEMIA ADV-EVERY 3 MONTHS FOLLOW UP

**Dr. Kim, sankrish:** (7/18/2006 12:31)

Kindly expert your opinion and management.
**General Information**

- **Presenting Complaint**: P. come for routine checkup.
- **Systemic Illness/History**: Known as DM 25 Yrs on Rx.

**Visual Acuity** (Unit: Snellen [Meters])

<table>
<thead>
<tr>
<th>Vision</th>
<th>Right Eye</th>
<th>Left Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un-Aided</td>
<td>6/12</td>
<td>---</td>
</tr>
<tr>
<td>Added</td>
<td>---</td>
<td>5/12</td>
</tr>
<tr>
<td>Pinhole</td>
<td>6/6</td>
<td>6/6</td>
</tr>
</tbody>
</table>

**Intraocular Pressure**

<table>
<thead>
<tr>
<th>Method</th>
<th>Right Eye</th>
<th>Left Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schiotz</td>
<td>mm Hg</td>
<td>mm Hg</td>
</tr>
<tr>
<td>Apparation</td>
<td>mm Hg</td>
<td>mm Hg</td>
</tr>
<tr>
<td>Non-Contact</td>
<td>20 mm Hg</td>
<td>14 mm Hg</td>
</tr>
</tbody>
</table>

**Signs**

<table>
<thead>
<tr>
<th></th>
<th>Right Eye</th>
<th>Left Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lid and Adnexa</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>
eyestalk

• Becomes a learning tool
• Empowers primary care ophthalmologists to manage all cases
• Easy accessibility for speciality care
In Tele-education
Tele-education — 5 hospitals in the weekly Grand rounds
Aravind - Wilmer Grand Rounds

...distance does not matter

Wilmer Eye Institute, Johns Hopkins University, Baltimore, USA
Tele-education
In conclusion…

• Telemedicine
  – takes speciality care to the unreached
  – empowers local community/professionals to access quality care and skills & knowledge
  – Sharing knowledge and expertise
  – saves time and money
Thank You