IOT in Health Care

Dr. Suresh Munuswamy
MBBS(Madras), MPH(Oxford), PhD(Tokyo)
Program Coordinator, MSc+PhD
Assistant Professor, IIPH-H
s.munuswamy@iiphh.org
1. IoT Description
2. IoT Evolution
3. IoT Application - Health Care
4. IoT Advantages - Challenges
5. Our Work - Contact
Eating out
Website

Dr. Suresh Munuswamy

Dr. Suresh Munuswamy, Program Coordinator and Assistant Professor at Indian Institute of Public Health- Hyderabad (IIH-H) has been associated with setting up, coordinating, running and promoting Govt. of India’s Integrated MSc, and PhD and HI-RapiD Lab (Health Informatics- Rapid Design Lab). Program In Health Informatics. The... Read More
The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and network connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.
IoT – Evolution

Medium + Interface Device + User interface

People and Patients

User Interface

Interface Device

Health Care Professionals

User Interface

Interface Device

People and Patients

Health Care Professionals

Cloud - Health

m - Health

ویبر

ویبر

Tele - Health

Tele - Health

www

www

m - Health

e - Health

e - Health

Telecom

Telecom
IoT – From – To - Ubiquitous
Budget 2018: Govt. Still Strong On Digital India; Allocates $480 Mn To Promote AI, ML, IoT

As Announced By Arun Jaitley During The Budget Session, NITI Aayog Will Launch A National Programme For AI Research

Sukanya Mukherjee

February 1, 2018 | 12 min read
IoT Grand Architecture

Software Layers
- Interconnectivity
- Data Base Model
- Interoperability
- Security Layers
- Ethics & Regulations
- Network Connectivity

Service Mapping
- Product Listing
- User Engagement
- Data Input Structure
- Data Analysis
- Result Visualization
- Admin Engagement
Digital Service Stages

STAGE 1
PUBLISH

STAGE 2
INTERACT

STAGE 3
TRANSACT

STAGE 4
INTEGRATE

STAGE 5
TRANSFORM
IoT – Service Stages

1. **Primitive**
   - Siloed sensors
   - Isolated M2M applications
   - Limited functions
   - Connected devices
   - Units inter-communicated
   - Lightweight protocols

2. **Tentative**
   - Managed services
   - Secured remote management
   - Reliable quality of services

3. **Advanced**
   - Smart decision
   - Contextual analytics applied
   - Harvest of knowledge and insights

4. **Dynamic**
   - Converged tech
   - Interplay with other disciplines
   - Unified intelligent solutions

5. **Optimized**
   - SMAC+; Rule engine, APIs, web services, machine learning, AI, Spark, Storm
   - Remote access, cloud, CRM/ERP/PLM integration, Hadoop, R
   - Dashboard, visualization, data mining, statistical modeling
   - Wearables, MQTT, XMPP, Zigbee, AllJoyn, KAA, ThingSpeak, Mango, Contiki
   - Sensor, embedded units, RFID, Transcends, fosstrak, OpenPCD, OpenBeacon
IoT Application in Health - Sensors

Figure 7a: BATTMISS – Potential Sensor Types and Medical Applications

Psychological arousal such as mental effort, excitement, shock, and especially stress. Diabetes. Bridge for assistive devices and Implants, Neonatal Monitor, Fetal Monitor, Hypo and Hyper Themia

Drug Delivery
Glucometer/Insulin Pump
Thermal Warmer & Cooler
Hazard Shielding/Sensing
Exo Skeleton
Electro Mechanical Prosthesis

Temperature, Lung and Heart Sounds
ECG, EEG Pulsoximeter
Accelerometer/Gyroscope/Pedometer
Fetal Monitoring
Implant Monitor
Galvanic Skin response

Can support MEMS

Fever, Heart Failure, arrhythmias, Intensive-care, post-operative monitoring, Asthma, Chronic Obstructive Pulmonary Disease, Fall detection, Activity monitoring (Parkinson’s, Alzheimer’s, Stroke), Rheumatoid Arthritis, Disabled (Blind and Deaf)
IoT Application in Health - Applications

Bio Electro Sensors on a Technical Textile [BEST] Platform with Expandable Modular Architecture for Health Care

**Sensors**
- Temperature/Blood Pressure
- ECG/Heart Rhythm/Pulse
- Respiration Rhythm/Rate
- 3D Movement/Location

**Accessories**
- Thermal Warmers/Coolers
- Inflatable Muscle Exercisers

**Future**
- Blood Diagnostics
- Continuous Medication
- ISHQ
- EMR

**Textile Tech**
- Embedded Circuitry
- Press Button Links
- Expandable Battery Casing
- Electromagnetic Shielding

**Software**
- Cloud EMR Link
- Programmable Alerts
- ISHQ/Natural Language Interface
- EMR Summary Print

Dr. Suresh Munuswamy
IoT Application in Health - Sensors

- Pressure
  - SQUID
- Temperature
- Biosensors
- Image
- Flow
- Accelerometer
- Encoders
Pressure sensors are used in anesthesia delivery machines, oxygen concentrators, sleep apnea machines, ventilators, kidney dialysis machines, infusion and insulin pumps, blood analyzers, respiratory monitoring and blood pressure monitoring equipment, hospital beds, surgical fluid management systems, and pressure-operated dental instruments.
Temperature sensors are used in anesthesia delivery machines, sleep apnea machines, ventilators, kidney dialysis machines, blood analyzers, medical incubators, humidified oxygen heater temperature monitoring and control equipment, neonatal intensive care units to monitor patient temperature, digital thermometers, and for organ transplant system temperature monitoring and control.
Applications for flow sensors include anesthesia delivery machines, oxygen concentrators, sleep apnea machines, ventilators, respiratory monitoring, gas mixing, and electro-surgery, in which high-frequency electric current is applied to tissue to cut, cause coagulation, dessication, or destroy tissue such as tumors.
Image sensor applications include radiography, fluoroscopy, cardiology, mammography, dental imaging, endoscopy, external observation, minimally invasive surgery, laboratory equipment, ocular surgery and observation, and artificial retinas.
Accelerometers are used in heart pacemakers and defibrillators, patient monitoring equipment, blood pressure monitors, and other integrated health monitoring equipment.
Spectrograph based Biosensors find applications in blood glucose and cholesterol testing, as well as for testing for drug abuse, infectious diseases, and pregnancy.
Magnetoencephalography (MEG) and magnetocardiography (MCG) systems use superconducting quantum interference devices or SQUIDs. These highly sensitive magnetometers measure extremely weak magnetic fields and are used to analyze neural activity inside the brain.
Encoders can be found in X-ray machines, magnetic resonance imaging (MRI) machines, computer-assisted tomography equipment, medical imaging systems, blood analyzers, surgical robotics, laboratory sample-handling equipment, sports and healthcare equipment, and other noncritical medical devices.
IoT Grand Architecture

Software Layers:
- Interconnectivity
- Data Base Model
- Interoperability
- Security Layers
- Ethics & Regulations
- Network Connectivity

Service Mapping:
- Product Listing
- User Engagement
- Data Input Structure
- Data Networking Analysis
- Result Visualization
- Admin Engagement
Data To Service

<table>
<thead>
<tr>
<th>Data: A measure of characteristic</th>
<th>Reliable, Representative, Real time (Possibly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information: Data placed in context</td>
<td>Analysis, Visualization</td>
</tr>
<tr>
<td>Knowledge: Application of information</td>
<td>Ecosystem &amp; Experience</td>
</tr>
<tr>
<td>Service: Application for particular use</td>
<td></td>
</tr>
</tbody>
</table>
Useful data:

- Closest from the source
- Continuous
- With meta data

Reliable data leads to valid service
IoT Advantages

- Economical
- Scalable
- Sustainable
- Improved Quality
- Improved Quantity
- Improved Equity
- Smarter People
- Simpler Processes
- Smaller Products
- Coordination
- Comprehensiveness
- Convergence
- Advantages
IoT Challenges

Challenges
Health Informatics

Institutional

Individual

Individual Vs System

Infrastructure
Our Work
3.0 HI-RAPID Lab @ IIPH-H

- Visual Graphics
- Computer Vision
- Visual Analytics
- Product Design
SHADO ME

Analysing Social and Health Attributes thru Daily Digital Observation on Mobile

Dr. Suresh Munuswamy
Assistant Professor
Indian Institute of Public Health-Hyderabad

Mr. Stephen Raj
2nd yr MSc. Health Informatics
Indian Institute of Public Health-Hyderabad

Mr. Stephen Raj
1st yr MSc. Health Informatics
Indian Institute of Public Health-Hyderabad
Project SHADO-ME scheme

Mobile Sensors
- Accelerometer/Gyroscope
- Microphone
- Light Sensor
- GPS
- Camera

Passive

Time Line - 1 Year

WHO SAGE Individual + Household Q

PHQ-9

Behavior Indicators
- Activity
- Conversation
- Sleep
- Location
- Facial Features
- CI: Future AR Apps

Active

WHO - SAGE

1. Socio Demographics
1.5 Work History + Benefits
2. Health State Descriptions
2.5 Anthropometrics, Performance Tests + Biomarkers
3. Risk factors + Preventive Health Behaviors
PHQ-9
1. Depression
4. Chronic Conditions + Health Services Coverage
5. Health Care Utilization
6. Social Cohesion
7. Subjective Well-Being + Quality of Life
8. Impact of Care Giving
Depression in Diabetics: Passive mobile sensing based evaluation.

Suresh Munuswamy 1,2*, Ramakant Vempati 3, Archana Sarda 1, Girija Chetty 1, Shubhankar Sarda 1, Stephen Raj 1,2, Priyadarshini Suresh 1,2

Methods: 47 participants with android smartphones, willing to download SHADO app were enrolled with due consent from a diabetes clinic in Aurangabad, India. The app passively recorded activity rates, frequency of screen-on, time, duration, number of calls, and travel distance. Socio demographics and depression status (PHQ 9) was assessed in person, followed by a bi-weekly telephonic interview over a 14 week period.

Results: 30 men, 17 women participated in the study. Mean age was 35 years (std. dev: 12). There was a high prevalence of depression (60%). Five had severe symptoms, including suicidal tendencies. Mean calls per day, activity at night, frequency of screen-ons at night were different for depressed vs non-depressed and significant at 95% CI. The mean activity rate for phone usage was 17% and it was high during day time. Mean calls per day were 17 (Std. Dev 14); mean time spent on the calls was 24.8 minutes (Std. Dev 22). Data for travel distance had several missing variables.

Conclusion: Depression in diabetes is widespread and existing validated questionnaires can be successfully administered over smartphones. Passive mobile sensing of activity and social contact has the potential to identify risk of depression in people with diabetes. Data annotation through telephone exploration calls with participants would further add value.

Abstract:

Introduction: Prevention, disease progress and self-management of diabetes are known to be influenced significantly by everyday social determinants. Project SHADO proposes daily digital observation through passive mobile sensing techniques to identify risk, evaluate and understand the pathway of influence.
Project AUTOMETRY
AUTOMETRY: See, Click, Measure - automatically and accurately

www.autometry.in

Algorithm in development

R&D
1. Iterative design and development
2. Validation
3. Clinical Testing
4. Public health System Feasibility
5. Ecosystem Feasibility
Final Output with Pixel Measurements

Good Contrast Image

Real Time Image
Support/ Similar “Autometry”

Nestlé Foundation

PHILIPS

sense and simplicity
Project

DISABILITY ASSESSMENT & SUPPORT
DAS Simple

- Augmented Reality (AR) based app model to calculate range of movements
- Icon based structured health questionnaire to assess disability components
- Database of disability benefits + Bio metrics device integration
- Automated link with GIS inputs for disability assessments to benefits
- Website + secure cloud 24*7 real time access CMS, data analytics dashboard for three years.
Student designs app that helps health workers assess disability

In what could be a boon to those with locomotor incapacity, a student from Indian Institute of Public Health (IIPH), Hyderabad, in association with fellow-students and faculty, has conceptualised an app that could assist health workers in disability assessment.

The app aims to make sure that one will not have to wait long queues to obtain a disability certificate. Instead, a health worker can visit the individual. On provision of supporting documents, the health worker will simply tap on the mobile app and ask the person to display a range of motions (movements of upper and lower limb).

As this person does this, the health worker can click on the list of icons that form the questionnaire. At the completing this, the app will give the exact extent of disability of the individual. The questionnaire is designed, based on the central guidelines of measuring disability. These are converted into pictorial icons, thus eliminating text and any language barriers.

The project has been given a grant by the Grand Challenges, Canada. The augmented reality (AR)-based model has been designed by Shilpy Bhat, a final-year student of the Integrated MSc and PhD in Health Informatics at the IIPH, under the guidance of assistant professor, Dr Suresh Munuswamy. They have been assisted by several other students from the course in Hyderabad and Bangalore. The app was presented at the Third Annual Healthcare IT India Summit held on Thursday.

Bhat says, “Our app named DAS Simple (Disability assessment made simple), is mainly designed in order to measure physical disabilities in simpler ways. Less than ten percent of the differently-abled people in India actually avail the benefits meant for them.”

Munuswamy said, “The app has been designed as per the government regulations and will be easy to access by any health worker. We have taken suggestions from various health experts including focused groups in Bangalore.” He added that the app could also help in creating a database of those with special needs. Bhat said, “We believe that the app addresses the issue of health and technology literacy.”

The government has a fixed set of benefits based on the extent of the disability. Right now, the app has to be certified by a panel consisting of doctors. Munuswamy said, “The app is likely to be ready by the initial months of next year and will be handed over to the Union government. After development, we will launch it on a pilot basis in Bangalore.”

Hemanth Kumar Naik, another student from IIPH, mapped Khammam – a district in Telangana, in order to measure the actual distance between the hospital and public health centres from the point of access of a differently-abled person.
<table>
<thead>
<tr>
<th>S.no</th>
<th>Movement Upper Limb</th>
<th>ROM using APP</th>
<th>ROM using goniometer</th>
<th>Image (APP)</th>
<th>Image Goniometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sh. Flexion-extension arc</td>
<td>148</td>
<td>150</td>
<td><img src="image1.jpg" alt="Image" /></td>
<td><img src="image2.jpg" alt="Image" /></td>
</tr>
<tr>
<td>2</td>
<td>Sh</td>
<td>23</td>
<td>25</td>
<td><img src="image3.jpg" alt="Image" /></td>
<td><img src="image4.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>
General patient registration
Locomotor Disability Assessment Types
Wrist Component
Augmented Reality Joint Angle/Range of Movement Measurement
Map View
Support/ Similar “ARGon”

Grand Challenges Canada®
Grands Défis Canada

BOLD IDEAS WITH BIG IMPACT®
DES IDÉES AUDACIEUSES AYANT UN GRAND IMPACT
ishq4u is one global language for primary health care.

ishq4u is a software concept for anytime, anywhere, reliable and validated health care service with automated decision support, management guidance linked to peer real and virtual support network in real time or batch mode.

ishq4u is one global language for primary health care based on graphic icons, pictograms and ideograms
imci- ishq version
AI + UI = ISHQ CHAT

Wysa

Is it true that you're trying to quit smoking?

Yup

Feeling confident?

No not really

It's a tough one, isn't it.

Wysa

Working together can make a big difference. I will check in with you ever other day around the time of your cravings and try to help.

Shall we try doing this together?

Yes

When you feel confident, we can set a Quit Date and tell everyone.

Until then, let's build confidence by 'fake quitting'.

What does it mean?

It's really simple.

Wysa

Before you reach for a cigarette, reach for me.

Just open our chat and say '#pause'.

Tell me more

We'll use simple techniques that people find helpful in gaining back control.

These could be as simple as getting a glass of water, or may involve thinking a little.

I promise they won't be boring!

Reply or say Help...
Settlements outside 5KM from PHC's
ROAD RAID Project- Results

Website- Facilities

Excel
Aarogyasri Facilities

Mapping of Emergency Care in Andhra Pradesh And Telangana

Mapping of Cadiac Care in Andhra Pradesh And Telangana
Aarogyasri Facilities

www.healthinformatics.in
Aarogyasri Treatment
PHC + Optimization
### All categories all district actual expenditure

Suresh Munuswamy & Souvik Bandyopadhyay

Rows add up to 100%

<table>
<thead>
<tr>
<th>No Category</th>
<th>Additional</th>
<th>Anaestheti</th>
<th>Anaigesics</th>
<th>Anti Anemi</th>
<th>Anti Malar</th>
<th>Anti Neopi</th>
<th>Anti Oxyto</th>
<th>Anti Parki</th>
<th>Anti Proto</th>
<th>Antialerg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibacter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anticonvul</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antidotes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antitfect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Blood Prod</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cardiovasc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dermatolog</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnostic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disinfecta</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diuretics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gastrointe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hormones &amp; Immunologi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mood Disor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Muscle Rel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ophthalmol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oxytocics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Peritoneal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Psycho The Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vaccines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vitamins</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water, Ele</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Aarogyasri- Dist-Mandal
Aarogyasri- Dist-Mandal

Maps-Nalgonda.xlsx - Microsoft Power Map for Excel
Aarogyasri- Dist-Spec
Field Research - Video Preparation
Drones tested to deliver drugs

In a novel scheme of utilising technology in healthcare, researchers at the Indian Institute of Public Health (IIPH) in Hyderabad are testing drones (unmanned aerial vehicles) to deliver drugs.

On a pilot basis, the researchers have been testing a drone at a Primary Health Centre (PHC) at...
COMPREHENSIVE and COORDINATED NUTRITION MOBILE MODULAR MANAGEMENT SYSTEM [COCONUT M3S]

One Device to unite Nutrition Management across protocols, programs, places and people...

Advantages
1. One device for several National Health Programs
2. User interface that needs no or little literacy
3. Automated services and automated analytics
4. At home service
5. Platform creation for faster roll out of future innovations
6. Comprehensive and coordinated management of nutritional indicators and nutrition cause linked adverse clinical outcomes, at the point of need, across all existing protocols, programs, and places to ensure all women and children thrive well with maximum support and minimum effort.

Protocol Track
- Anthropometry = AUTOMETRY
  - Biochemistry =触摸无侵入
  - Clinical = ISHO
  - Dietary = ISHO

People Track
Girl/Boy
- NHP Adolescence
- Anemia Screening
- Pregnancy Risk Score
- NHP Mother and Child

ABCD Assessment

Hand Set
- ABCD
- 3kg

Base Set
- MIL-STD
- 810

Coordinated
1. National
2. Builds on pre-
3. Icon Based
Health Programs and Management Minimal Text

Team IIPHH: PI- Dr. Suresh Munuswamy; Co-PI- Prof. G.V.S. Murthy; Co-I- Mr. Souvik Bandyopadhyay/ Consultants: Dr. Balia Pesala CSIR-CEERI; Dr. Suman Devadula IISc; Mr. Balaji Kanigicherla INEDA; Mr. Srikanth SL BPL Medical Tech.
Research Associates: PhD Candidates at IIPHH- Dr. Himanshu Sharma; Dr. Arpit Awasthi; Mr. Hemantha Naik; Mr. Saurabh Gupta; Dr. Nukala Lovakanth; Ms. Shilpi Bhat.
i-SpecAL: Spectroscopy + Icon UI+ Augmented Intelligence base

Project CHILLI PS SpecAL

1. ANC Chat Bot (Developed)
2. Socio Demographics
3. Height
4. Weight
5. Abdominal Examination
6. Blood Hemoglobin
7. Urine Albumin
8. Iron & Follic Acid Tabs
9. TT Vaccination

A. Map + Cloud Link (Developed)
B. HSI - Based (Proposal)
C. Product Link (Developed)
D. Comprehensive Coordinated Convergent

Info Graphics Designed by Dr. Suresh Munuswamy

www.healthinformatics.in
Contents

1. IoT Description
2. IoT Evolution
3. IoT Application - Health Care
4. IoT Advantages - Challenges
5. Our Work - Contact
Thank you..
Reach Out

Dr. Suresh Munuswamy  
MBBS(Madras), MPH(Oxford), PhD(Tokyo)  
Program Coordinator, MSc+PhD  
Assistant Professor, IIPH-H  
s.munuswamy@iiphh.org