# ITRA- HUMAN SENSE

**Towards context aware sensing, inference and actuation for applications in Energy and Healthcare**

**CLOSURE REPORT**

**by**


**CSE Department**

**PI- Prof. SRN Reddy**

**Indira Gandhi Delhi Technical University for Women**

**Kashmere Gate, Delhi-110006**

IIIT-D | Shiv Nadar University | media lab asia — innovating for Digital Inclusion

# About IGDTUW

Indira Gandhi Delhi Technical University for Women (IGDTUW) has been upgraded from Indira Gandhi Institute of Technology in May 2013 vide Delhi State Legislature Act 9, 2012, as a non-affiliating teaching and research University at Delhi to facilitate and promote studies, research, technology, innovation, incubation and extension work in emerging areas of professional education among women, with focus on engineering, technology, applied sciences, management and its allied areas with the objective to achieve excellence in these and related fields.

**http:www.igdtuw.ac.in**


# CSE Dept., IGDTUW

The **Computer Science and Engineering Department** is the most versatile department of college and caters to the needs of other departments as well. The department aims at developing the fundamental conceptual knowledge along with the total personality, which helps computer engineers to face the challenges of rapidly changing software industry. Technical skills, teamwork and specialized knowledge prepare these young engineers to adopt and continuously learn new technologies.

# Startup-ETI LABs Pvt. Ltd.

Our mission is to minimize the gap between theoretical and Practical education in engineering institutions by providing wide range of integrated materials which includes Theory (book), Practical (Kit +manual) & real-life projects (project kits) towards innovation . Home automation which is the outcome of ITRA is taken as the base product for the further developed. At ETI labs our attempt is to break through all potential barriers in study of hardware and software based courses by providing hands-on technical training in various domains. We also provide a range of electronic design services to assist you throughout the electronic product development cycle. ETI labs offers a set of complementary components that enable experimentation on innovative services for academic and industrial users

www.etilabs.com


## Contact Details

**Name: Prof. SRN Reddy**
**Email id : srnreddy@igdtuw.ac.in**
**Phone No.: 09810101742**
**/ and http://www.mobileeducationkit.net/**

## Media

- My Smart phone Kit@ EFY
- Project featured in Eenadu Newspaper

# Vice Chancellor's Message :-

DR. AMITA DEV
VC,IGDTUW,DELHI

Indira Gandhi Delhi Technical University for Women has played a major role in capacity building and imparting high quality technical education to the women of our country. The University aims to incubate new ideas, encourage innovations and research work in multidisciplinary areas of Engineering, Science and Technology. The University offers a number of U.G., P.G., and Ph.D. programmes in the area of Engineering, Architecture and Technology.

The objective of the University is to promote research among young women and to provide knowledge workers to boost the knowledge economy of our country The MHRD has provided the opportunity to explore the real time idea by giving the platform of ITRA:HUMAN SENSE at IGDTUW Delhi which focuses on innovations around engineering products, add value to the available engineering designs and promote incubation of start-up companies. Several innovative ideas are being hatched for developing a new pedagogy in teaching and training in design, development and new fabrications and techniques.

Some of the start-of-art technologies developed under ITRA(MHRD) are My Smart Phone Kit, Edu Tab, Sense Comm kit, remote healthcare monitoring, Soil Sensing Kit, Aqua Sensing technique to name a few. This lab is equipped with 3D Printer, in built Embedded devices, Learn Board Interfacing Node MCU, Raspberry Pi, Arduino, Qualcomm Dragon Board, Intel Galileo, communication interfaces etc.

ITRA @ IGDTUW Delhi, has carried out specialised class room courses and laboratory training in the above technical areas leading towards innovations. Laboratory facilities have been developed to provide infrastructure for designing and development of new products and processes with the help of My smart Phone Kit, Sensor devices, 3D Printer, Embedded devices, etc. ITRA @ IGDTUW works in collaboration and under the mentorship of IIIT Delhi and SNU with following objectives –

- To enhance knowledge and impart training to students leading towards innovation.
- To provide laboratory facilities in specified areas of technical expertise and guide students to develop targeted prototypes and products.
- To develop facilities for testing and optimisation of prototypes and user trails.
- To evolve team work driven by synergies required for incubating start-ups and to promote entrepreneurship.
- To facilitate patent filing for innovative ideas and products.

I convey my best wishes to the team working at ITRA to succeed in all their endeavours and realise the dreams of creating indigenous designs and home grown fabrication technology.

# Principal Investigator & Lab In charge- @IGDTUW

## Prof. S. Ramanarayana Reddy

**Prof. S. Ramanarayana Reddy** is working as a Professor in Computer Science &Engg dept of Indira Gandhi Delhi Technical University for Women (IGDTUW), Delhi. He is currently acting as a Dean examination affairs, IGDTUW. He has awarded PhD in the area of Embedded Systems Design in 2009 and M. Tech degree in 2002 from Jawaharlal Nehru University, New Delhi. His research interest includes Engineering Education, Embedded Systems Design, Mobile Architecture and Programming and IoT. He has published more than 80 research papers in various international journals, conferences and published couple of book. He filed four Indian patents along with his research team & collaborators and transferred the patented technology **"MySmart Phone Kit"** to the industry for commercialization.

He is a PI in six externally funded sponsored projects by Microsoft, Intel and Nokia and Co PI for two MHRD sponsored projects in collaboration with IIT Delhi and IIIT Delhi and completed two projects successfully. He established the state of art Embedded & Mobile Design and IoT Innovation lab in collaboration with Intel, Microsoft, Nokia, Atmel, ARM etc. to provide the quality of education and research with a practical approach. He has received several equipment's grants from Intel, Nokia, Microsoft, ARM, IT to name a few and received international travel fellowship from Intel twice. He has conducted more than 40 workshops/ training programs on 'Mobile Architecture and Programming', IoT, Design and Development of Smart Devices for Industry, faculty members and students. He has conducted few tutorials in the national and international conferences and delivered several expert lectures/ keynote sessions. He has more than 20 years experience that includes research, industry and teaching. He is a member of CSI, VLSI Society of India and AMIE and guided several M.Tech students and PhD students. He received the fellowship from Intel to visit and present the work in USA and Taiwan. He also received an award from Intel for his contribution and promoting technology in higher education. He was a one of the founder director of IGDTUW Anveshan Foundation, Section 8 Company and acting director of ETI Labs Pvt, Start-up company started at IGDTUW. He has published several course development manuals along with the research students and are available @ www.mobileeducationkit.net .


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***for more information about Prof. SRN Reddy kindly visit this link**
**http://mobileeducationkit.net/contact-us.php**

# ITRA –Human Sense

ITRA | INFORMATION TECHNOLOGY RESEARCH ACADEMY

ITRA is designed to produce a large numbers of IT researchers who are well equipped with the latest IT knowledge, educated in relating classroom knowledge to developing solutions, trained to spot problems amenable to IT solutions, motivated to identify societal problems in IT and other domains, and exposed to mechanisms for converting lab solutions to working prototypes. At IGDTUW,We have received Project name **"ITRA- Human Sense: towards context aware sensing, inference and actuation for application in Energy and healthcare."**

| Project Name | ITRA –Human Sense |
|---|---|
| Duration of Project | 2013-2017 |

## Team Structure: Principal Investigators

| | |
|---|---|
| Dr. Amarjeet Singh and Dr.Pushpender Singh, , IIIT Delhi | amarjeet@iiitd.ac.in |
| Dr. Debopam Acharya, SNU | Debopam.Acharya@snu.edu.in |
| Dr. S. R. N. Reddy, IGDTUW | rammallik@yahoo.com |

## Summary and Vision

Consider a world where every human is empowered with information that helps her (and therefore eventually the whole ecosystem) in making optimal use of available resources. Such a vision can be realized using recent technology advancements, in low cost and pervasive sensing, on-device and cloud computation, and ubiquitous communication, allowing for collection of individual-specific data about her activities and the corresponding context in which these activities are performed, which can be environmental, social, economic, cultural and educational, among others. The HumanSense project proposes to monitor and adapt to individual and context specific requirements to enable systemic studies, thus paving the way for data-driven research to deliver public goods. It will build upon proven technologies and platforms, while exploiting the research and field deployment capabilities of the team, collaborators and advisory board members. Wider participation and long term sustainability will be ensured through open dissemination of collected data and project outcomes.

# Collaborators

## *Academic*

Dr. Ram Manohar Lohia Hospital and
Post Graduate Institute of Medical Education and Research
New Delhi, India, A Central Government Hospital (Formerly Willingdon Hospital)

## *Industry*

MHRD
Govt. of India

Trinty
Microsystems
Pvt. Ltd


## Online Support

**www.mobileeducationkit.net**

**www.mysmartphonekit.mobileeducationkit.net**

# Project Staff

## Research Fellows: Mr. Pawan Kumar(In lieu of Ms. Nidhi Aggarwal)

**Working Project :- Home Automation**

**Research Area :- Design Objective:**

(a) Design and Development of energy efficient, secure and cost effective, maintenance free, scalable, easy to install, environmental and health friendly Home Automation System

(b) Design and Development of a Mobile Application for remote Monitoring and control of Home Appliances.

(c) Design and develop a IoT based Real-time Data logging System/Server that communicates with Mobile Application for Real time data logging for Analytics purposes.

Later, Home automation is taken in ETI LABs start up with collaboration with other projects supported by:

**Ms. Manasi Mishra**

**Mr. Rachit Thukral**

## Research Fellows: Ms. Sonal

**Working Project :- Remote Healthcare**

**Research Area :- Design Objective:**

a) Design and Development of an integrated solution for the evaluation of different physiological parameters (heart rhythm, oxygen saturation level, temperature, etc) for screening, detection and early diagnosis of Complex Congenital Heart Diseases at remote primary health care centre.

b) Development of mobile application for wireless monitoring and onward transfer of these parameters from primary to tertiary care centres so as to identify potentially sick babies for referral and transfer to tertiary care centre

## Research Fellows: Ms. Zeenat Shareef

**Working Project :- Framework For Aquaculture**

**Research Area :- Design Objective:**

Design and development of prototype to monitor the quality of water in ponds in remote areas. The prototype consists of sensor node to measure physio-chemical parameters of water and transmission of these parameters to nearby server for storage and analysis.

# ITRA: Human Sense –IGDTUW Financial Details

| S.No. | Financial Year | Grant Received | Sanction No. |
|---|---|---|---|
| 2 | 2013-2014 | Rs. 7,30,000/- | ITRA/15(57)/Mobile/HumanSense /2013-14 |
| 1. | 2014-2015 | Rs. 10,15,000/- | ITRA/15(57)/Mobile/HumanSense /2014-15/02 |
| 2 | 2015-2016 | - | |
| 3 | 2016-2017 | Rs. 3,75,000 /- | ITRA/15(57)/Mobile/HumanSense /2016-17/01 |
| **Total** | | **Rs. 21,20,000/-** | |

| | |
|---|---|
| **Total Grant Received** | **Rs. 21,20,000/-** |
| **Total Expenditure Incurred** | **Rs. 1962273.90/-** |
| **Amount Left at the end as on 31.03.2018** | **Rs. 1,57,726.10/-** |

** Various components and other benefices purchases are also supported by ITRA funds which are also included in expenditure incurred under the head capital equipment.

**Status of Project:-**Project was done successfully completed.

# ITRA: Human Sense Manpower

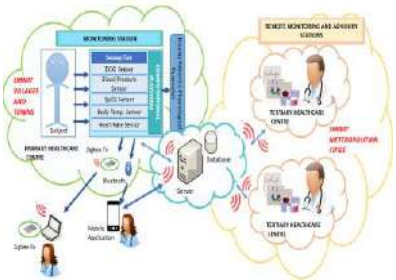
**Details of manpower associated with project:-**

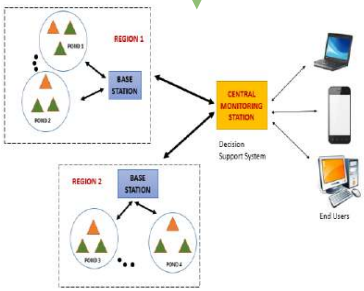
| S.No | Name | Designation | Qualification | Date of Joining | Date of Leaving | Total average emoluments (monthly) |
|---|---|---|---|---|---|---|
| 1. | Nidhi Agarwal | Teaching Assistant | M.Tech | April 2014 | August 2014 | 20,000 p.m |
| 2. | Pardeep Kumar | Project Associate | B.Tech | April 2014 | Nov-15 | 15,000 pm (April'14-March'15) 18,000 pm (April'15-Nov'15) |
| 3. | Nidhi Agarwal | PhD Scholar | Pursuing PhD | Sep- 2015 | Aug-2016 | 32,000 pm |
| 4. | Sonal | PhD Scholar | Pursuing PhD | Jan- 2016 | Nov-2016 | 25,000 pm |
| 5. | Pawan Kumar | PhD Scholar | Pursuing PhD | Nov-2016 | April 2017 | 25,000 pm (Jan16-Dec16) |
| 6. | Zeenat Shareef | PhD Scholar | Pursuing PhD | Jan- 2017 | June 2017 | 28,000 pm (Jan 17-Jun 2017) |

** Apart from this various students have been undergone summer training and summer internship under ITRA: Human Sense Project.

# Research Highlights

| Parameters | Home Automation | Remote Healthcare | IoT Based Framework for Aquaculture |
|---|---|---|---|
| **Team** | Prof. S.R.N. Reddy<br>Pawan Kumar<br>(In lieu of Nidhi Agarwal) | Prof. SRN Reddy<br>Sonal<br>Dr. Dinesh Kumar | Prof. SRN Reddy<br>Zeenat Shareef<br>Dr.Ramprasad |
| **Problem** | Domestic sector contributes to carbon footprint and green house effects. | Health care centers located in remote villages and small towns lack basic amenities like equipment and highly qualified doctors to detect and treat babies with CCHD. | Water quality monitoring is important for the survival of fishes. Automatic remote water quality monitor needed for early warning system and avoiding losses. |









**** Initially supported by ITRA and now followed by MHRD DIC**

# Innovative Project Highlights

# Home Automation

*Practical Approach for Technical Education & Research*

**Home Automation**: Home automation or smart home is the residential extension of building automation and involves the control and automation of lighting, heating (such as smart thermostats), ventilation, air conditioning (HVAC), and security, as well as home appliances such as washer/dryers, ovens or refrigerators/freezers that use wireless communication technology for remote monitoring.

**Remote Monitoring**: Apps can provide a wealth of information about your home, from the status of the current moment to a detailed history of what has happened up to now inside the home. You can check your security system's status, whether the lights are on, what the current temperature of your home is and much more.

**Remote controlling**: You can control your devices remotely with the help of your smartphone or desktop via any wireless communication technology such as Bluetooth, wifi etc

## System Features

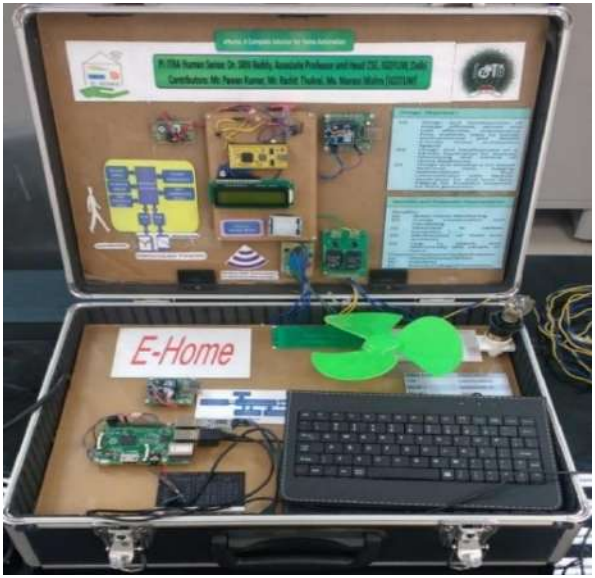
- ❑ Miniature nodes deployed at different locations in a room/house
- ❑ Cost effective and affordable system for Indian users.
- ❑ Anytime, any level scalability
- ❑ Heterogeneous nodes for meeting low cost criterion
- ❑ System to operate on a number of available communication interfaces with ease

## Benefits

- ❑ Better Home Monitoring
- ❑ Energy Conservation and Harvesting
- ❑ Reduction in carbon footprints,
- ❑ Minimization of theft and accidents
- ❑ Help to elderly and differentially able people at home

## Proposed Deployments/Applications:

- ❑ Home/Houses/Offices
- ❑ Industries
- ❑ Schools/Colleges/Universities




E-home kit is designed to be used for M.tech, Btech & diploma courses of CSE/IT/ECE/EEE etc as case study environment for various courses Mobile Computing, Embedded System, Wireless Communications, Internet of Things, and Programming Languages like Python, C, and Shell Script etc

E-Home is a complete system for automatic as well as manual controlling of various home appliances

# Innovative Project Highlights –Home Automation As Base Product from ITRA later taken by ETI Labs

## Smart Fan switch



- Multi mode operation
  - Manual ON OFF switch (traditional)
  - Automatic temperature controlled
  - Manual smartphone controlling through android application
- Energy saving
- LCD Display for temperature, humidity, Load status & instantaneous power consumption
- Remote monitoring of above parameters using cloud platform

## Smart light Switch




- Multi mode operation
  - Manual ON OFF switch (traditional)
  - Automatic light intensity controlling
  - Manual smartphone controlled through android application
- Energy saving
- LCD Display for instantaneous power consumption
- Remote monitoring of instantaneous power consumption using cloud platform

## LPG leakage detection system

- Alert the user if LPG leakage is detected in the environment by making buzzer sound
- Automatic switching ON exhaust fan to remove the leaked gas
- Notifies the user by sending alert notification of gas leakage so as to make him aware if he is away from that place

## Environmental monitoring system

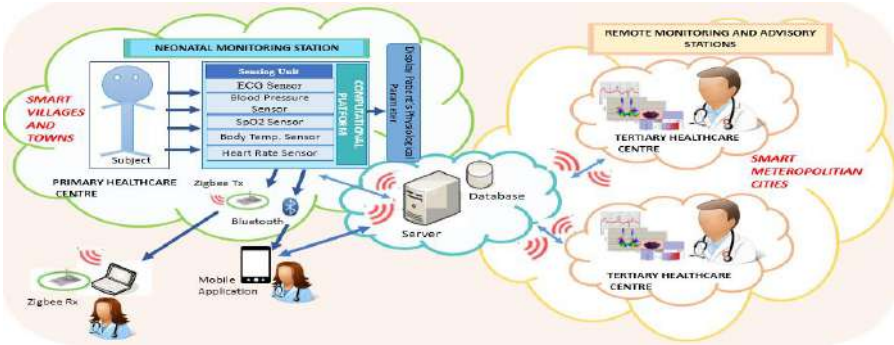
- Display temperature, humidity & air quality of the environment
- Sends the data to the cloud for remote monitoring of the parameters anytime & anywhere
- Mobile app for monitoring environmental parameters using smartphone

# Innovative Project Highlights

**** Initially supported by ITRA and now followed by MHRD DIC**

## Remote Healthcare

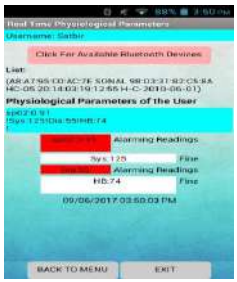
Remote healthcare conceptualized the prototyping design which provides an integrated IoT solution for the evaluation of different physiological parameters essential for screening, detection and early diagnosis of Complex Congenital Heart Diseases at remote primary health care centres (located at villages and small towns). Along with that Design and Development of mobile application with wireless monitoring and real time remote transfer of interpreted physiological parameters from primary to tertiary care centres has been done so as to identify potentially sick patients for referral and transfer to tertiary care centre within stipulated time. Remote advisory feedback also incorporates the facility of inter communication between different healthcare centres.




### System Features

- Promote integration of healthcare centres as collaboration of a healthcare teams with each others is established.
- Promote quality healthcare as various health parameters are measured and optimal disease detection is there.
- Flexibility to the doctors is provided as mobility is added on in the form of mobile phone application on which different parameters can be viewed.
- Future retrievals of the health parameters and feedback advisory system provides easy reach and intercommunication between the healthcare centres.






# Innovative Project Highlights

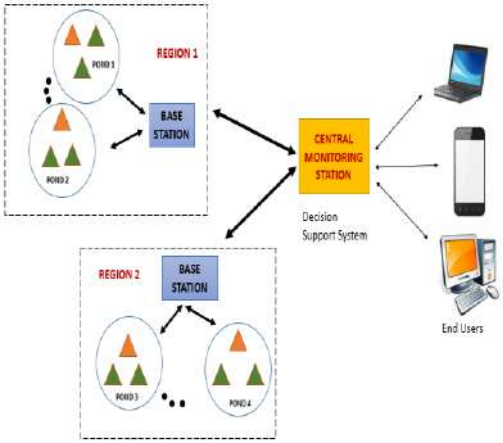
## Framework for Aquaculture

** Initially supported by ITRA and now followed by MHRD DIC

**Aquaculture** is cultivation of marine animals under controlled conditions. Automatic water quality monitoring still doesn't exist.

Aqua-culture farmers in remote areas face problems of fish mortality due to deviation of water parameters due to one or more reasons. These farmers are unable to predict the changes in water quality and therefor are not able to take any preventive actions to save their fishes. As a result, they occur heavy losses every year and this deteriorates their financial condition.

AquaSense is a remote water quality monitoring framework which can be deployed in fish farms in rural areas. This framework provides facility for remote monitoring of water-parameters such as water pH, water temperature and water dissolved oxygen levels, storage and analysis of these parameters at remote server and sending alerts to the farmers whenever water parameters deviates from the threshold.




### System Features

- ❑ Sensor nodes collect the water quality parameters such as **dissolved oxygen, water temperature, pH**
- ❑ Data stored in cloud platform for easy accessibility.
- ❑ Real time remote monitoring of water parameters.
- ❑ Early warnings to farmers to take preventive actions.
- ❑ Specially designed for aquaculture farmers of Bhimavaram region.

# Innovative Project Highlights

**** Highly supported by Microsoft and partially by DIC and ITRA**

## My Smart Phone Kit

*Practical Approach for Technical Education & Research*

My Smart Phone Kit is designed to be used for M.Tech, B.Tech, MCA, BCA, MSc, and Diploma courses of CSE/IT/ECE/EEE etc. as an experimental environment for various courses such as Mobile Computing, Embedded System, Wireless Communications, Internet of Things, and Programming Languages like Python, C, and Shell Script etc.

### System Features

- ❑ It can be used to practically teach several subjects of engineering with the aid exercises and hands-on with the real environment.
- ❑ It provides an open environment for design and development of smart devices.
- ❑ It Provides 3 dimensions of freedom: Hardware, Operating System and Software Control of the Kit.
- ❑ The Online resources for the Kit are available on the Mobile Education Kit, a part of the Mobility Research Forum.

## UI Design & Development

*UI for My Smartphone Kit*


The UI designed for My Smartphone Kit on PyQT platform. It implements a framework for prototyping a working solution that is able to provide a two ways communication between the typical end-user and the Raspberry Pi. In this project the Qt Framework is evaluated as the tool that can support the cross platform development of desktop, mobile and embedded applications. PyQT helps us to develop application software that can be run on various software and hardware platform with little or no change in the code base.

### Application

The result of this implementation proves that the Qt Framework is an effective solution for the development of user interfaces, offering powerful GUI creation tools and wide range of supported platforms

# RESEARCH: Publications & Professional Activities

## **Book:** * In collaboration with other projects(MEK, DIC)

**Version 2:** Dr.SRN Reddy, Suresh Chande **"Design and Development of Smart Phone: A Practical Approach by using Raspberry Pi",** SPD,revised January 2016**.**



## **Patent:** * Partially Supported by MEK Project

1. Title: **A System for Building, Customizing Software and Hardware Interfaces of Smart Phone using Raspberry Pi,**
Application Number: **2354/DEL/2015**
Filing Date: **28/01/2015**

2. Title: **Aqua-parameters monitoring and controlling**
Application Number: **201611017103**
Filing Date: **8/5/2016**

# RESEARCH: Publications & Professional Activities

## Professional Activities: ** In collaboration with DIC, Intel projects

1. Organized Hackathons on the topics "**Home Automation**" and "**Campus Monitoring System**" in collaboration with Intel during the techfest "INNERVE" of IGDTUW.
2. Organized Research Showcase 2016 for B.Tech and M.Tech students for providing them a platform to showcase their minor, major and dissertation projects to industry and academia.
3. Organized National Conference on Product Design 2016 which was held in MSRIT, Bengaluru in collaboration with Microsoft, Intel and other collaborators from academia and industry.
4. Organised six weeks Summer Training Programme VIII on "**Build your own IOT Devices**" in IGDTUW.
5. Several one day workshops on various platforms for B.Tech and M.Tech students.

## Awards and Honours: ** In collaboration with DIC, Intel projects

1. Dr. SRN Reddy, Assoc Prof. was awarded for **Promoting Technologies for Higher Education and Fostering an Inclusive and Innovative Education** in India by the Vice President, Intel.
2. Manasi Mishra, Dr.SRN Reddy won second prize for **M.Tech Dissertation 2016** held at IGDTUW.
3. Zeenat Shareef, Dr.SRN Reddy won first prize in **National Conference on Product Design 2016** sponsored by Microsoft and Intel held in MSRIT Bangalore, for the project "IOT Based Framework for Aquaculture".
4. Mr Sanjay Kumar (Research Associate), Ms. Zeenat Shareef (PhD Scholar), Dr.SRN Reddy won First position at **Research Showcase** held at Indira Gandhi Delhi Technical University for Women. Cash award was presented by Mr.Manish Sisodia, Dy.C.M Delhi.

## Technology Transfer:

MY_SMART PHONE KIT [Sponsored by Microsoft Mobile University Relations (Nokia University Relations) and Association with MHRD(DIC & ITRA)] is designed to be used for M.Tech, B.Tech, MCA, BCA, Diploma courses of CSE/ITECE/EEE as a practical experimental setup for various courses. Patented Technology is transferred currently to one manufacturer to produce My Smart Phone kits: Ms. Trinity Microsystems Pvt. Ltd. Delhi.

## Business Proposals:

Business plan prepared and submitted for two proposals namely eHomes & My Smart Phone Kit Enabled Lab

# RESEARCH: Publications & Professional Activities

## Pilot Survey/User Interaction: ** In collaboration with DIC, Intel projects

1. Survey was conducted with aquaculture farmers at Bhimavaram, Andhra Pradesh regarding their current practices and requirements for the project "IOT Based Framework for Aquaculture" and frequency analysis was performed on the same.
2. Visit to Aquaculture Department in Undi, Andhra Pradesh for real time user interaction and feedback for "Aquaculture Project".
3. Visit to RML Hospital, Delhi to analyse the real-time scenarios and people need. Survey analysis of prototyped node of healthcare with frequency statistics results for Remote Healthcare Project.
4. Visit to IARI, Delhi and KVK, Undi to interact with the agriculture scientists and survey about the problems, the crops and requirements for "Agriculture Project".
5. Survey of the project "Home Automation" was conducted to identify the challenges and research gaps.

| | |
|---|---|
| **Papers published in Journals/ Review** | **10** |
| **Papers Published in Conferences** | **25** |

## Recent Publications:

1. **Sonal, SRN Reddy and Dinesh Kumar "Review of Smart Health Monitoring Approaches with Survey Analysis and Proposed Framework"** (IoT-4553-2018.R1) **IEEE Internet of Things Journal, Indexing SCIE, Scopus, etc.** - Accepted
2. Zeenat Shareef, SRN Reddy, " **WSN for Aquaculture**", Journal of Ambient Intelligence and Smart environment, IOS Press- Accepted

## Other Activities: ** In collaboration with DIC, Intel projects

1. Invited by Niti Aayog and Intel to judge the projects of **Schools** for Atal Tinkering Labs for setting up IoT Centres in these schools.
2. Invited by Niti Aayog and Intel to develop **an Operation Manual for Tinkering Labs** for the selected schools.
3. Presented student projects in **Delhi Pavilion during India International Trade Fair 2016.**
4. Dr. SRN Reddy presented the project Home Automation at **NASSCOM 2016** at Banagalore in October 2016.

# Knowledge Dissemination

** In collaboration with MEK, DIC, Intel projects

## 1. Wireless Sensor Networks

Wireless Sensor Network course offered in fifth semester of M.Tech (part-time) students . The primary objective of this coursework is to educate students about the detailed architecture of sensor networks and its design. The main focus is to enlighten students toward the practical approach of wireless sensor networks, architecture and its applications. The practical sessions were conducted that involve the creation, designing and deployment of different heterogeneous sensor nodes and creating a wireless sensor network using these nodes. The course also tries to enlighten about of the Quality of Service parameters of WSN with the help of created network by the students.

Some of the activities which are undertaken as a part of this course include:

- Design and develop a wireless sensor in various field such as home security, environment-weather monitoring, kitchen monitoring, smart parking, etc.
- Experimenting QoS parameters of WSN using Sampling and packet formalizations
- Evaluate the QoS parameters in the created smart WSN consisting of multiple heterogeneous nodes
- Introduction to Tiny OS and hands-on tiny OS installation on ubuntu environment and understanding the concept of tiny OS.

**Board Used in this course**


**Raspberry pi 2,3 and Arduino UNO,Mini,Nano**

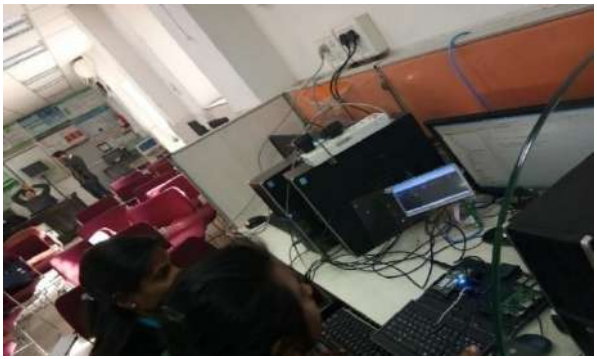
## Knowledge Dissemination ** In collaboration with MEK, DIC, Intel projects

# 2. Design and Development of Mobile Devices

This is a course offered in the first semester to M.tech (Mobile and pervasive computing, CSE) students who are fresh entrants to programme & B.Tech, CSE, 6th semester students. The primary objective of this course is to provide the practical aspects to the students about mobile architectures and development tools used for mobile application development including working with various hardware components, emulators and Application Programming Interfaces. Develop skills in the analysis, evaluation and implementation of mobile computing principles as well as the appreciation of mobile platform project development issues, such as design, development, communication, management, usability and related issues. Finally, to build the smart applications with prototypes of real h/w and s/w .

Some of the activities which are undertaken as a part of this course include:

- Theory sessions on the latest mobile architectures with case studies
- Experiential learning lab sessions and workshops
- Exposing students to successful research cases, products and innovations which have reached people/industry/society.
- Project development sessions among students in smaller groups to engage in exercises pertaining to programming, technology and innovation.



**Board Used in this course**



Intel galileo & Raspberry Pi zero W

# Knowledge Dissemination ** In collaboration with MEK, DIC, Intel projects

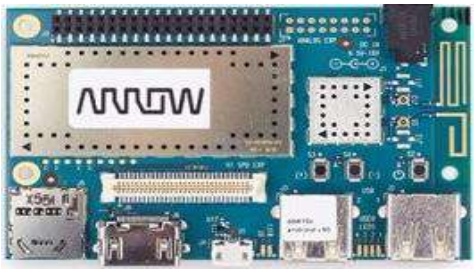
## 3. SoC Design

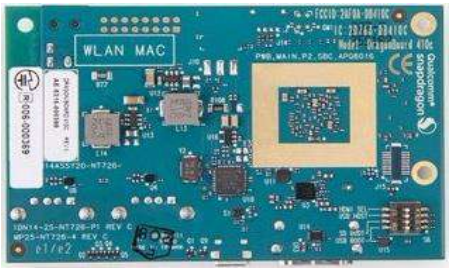
This is a course offered in the second semester to M.Tech (Mobile and pervasive computing, CSE) students who has basic understanding of processor, microcontrollers and system design. The primary objective of this course is to educate students about System-on-chip (SOC) design methodology and IP (intellectual property) reuse, system modelling and analysis, hardware/software co-design, behavioural synthesis, embedded software, reconfigurable computing, design verification and test, and design space exploration. Class projects focusing on current SOC design and research. Snapdragon board based on SOC are provided to prototype, test, and evaluate SOC designs. Finally, the students will build the prototype based on the selected SoC

Some of the activities which are undertaken as a part of this course include:

1. Theory sessions on the SoC design methodologies and IPs with case studies of latest SoCs
2. Experiential learning lab sessions and workshops on snapdragon SoC based board
3. Exposing students to successful research cases, products and innovations which have reached people/industry/society.
4. Project development sessions among students in smaller groups to engage in exercises pertaining to design thinking and development of prototype using SoC

**Board Used in this course**






**Snapdragon dragon board & Raspberry Pi zero W india,etc**

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## 4. Embedded System Design

This is a course offered in the second semester to M.tech (Mobile and pervasive computing, CSE) students who has basic understanding working with mobile and embedded devices . The primary objective of this course is to educate students about embedded design life cycle, embedded controllers , architectures and interfacing. The course is taught by providing practical experience of embed and 8051 architecture , hardware and software for embedded systems, their interfacing and programming. Interfacing of various hardware and software modules with the embedded systems and using embedded controllers to the specific applications. Students got a hands on experience with ARM , ATOM processors , RTOS also. Class projects focusing on design and development of various smart embedded devices that are self operable and self controlled.

Some of the activities which are undertaken as a part of this course include:

- Theory sessions on the embedded design life cycle, hardware and software co-design, embedded controllers and processor selection, study of ARM and ATOM architecture and their programming
- Exposing students to successful research work , innovative products and applications that have been developed in the lab
- Project development sessions among students in smaller groups to engage in exercises pertaining to design and development of smart applications using embedded boards and controllers.

**Board Used in this course**

8051 and Raspberry Pi 2,3

# Knowledge Dissemination

## Expert Lectures: ** In collaboration with MEK, DIC, Intel projects

1. Invited lectures on “Mobile Architecture and Programming a Practical Approach by using smart phone kit”, SVU, Tirupathi, 4th July 2016
2. Invited lectures on “Mobile Architecture and Programming a Practical Approach by using smart phone kit”, Visheveshwaraish college of Eng. Madanapalli, 3rd July 2016
3. Invited lectures on “Mobile Architecture and Programming a Practical Approach by using smart phone kit and IoT”, Vishstnu College of Eng. Bhimavaram, 9th July 2016
4. Invited lectures on “IoT and Smart phone kit”, JNTU college of Eng. Guntore ,10th July 2016
5. Invited lectures on “IoT and Smart phone kit”, FDP organised by JSS, Noida, 2016.
6. Invited lectures on “IoT and Smart phone kit”, Hindustan College, Mathura, December 2016.

## Workshops: ** In collaboration with MEK, DIC, Intel projects

1. Two days hands–on workshop on Build My_ Smart Phone for faculty at MSRIT, Bengaluru held during 07 & 08 Jan 2016 in collaboration with IGDTUW, Delhi & Mobility Research Forums.
2. One day hands-on workshop on Raspberry Pi and its interfaces for B.Tech students, 13 Feb 2016 at IGDTUW, Delhi.
3. Six weeks **Summer Training Programme – VIII** on Build Your Own Smart Device in 2016.
4. One Week hands–on workshop on **Building Your Own Smart Phone** for faculty at NITTR, Chandigarh held during 16 to 20 May 2016 in collaboration with IGDTUW, Delhi & NITTTR, Chandigarh with support from Microsoft, Intel & DIC-MHRD.
5. One day workshop on “**Intel RealSense**” 18th July 2016 for BTeh and M.Tech students of IGDTUW.
6. One day workshop on **Embedded System** using Intel Galileo Gen 2 on 2nd April 2016 for M.Tech students of IGDTUW.
7. Two days workshop on Build your own smart device using Intel Galileo, Raspberry Pi at MSRIT, Bengaluru during 1st-2nd July 2016.
8. One day workshop on “Experiments on Raspberry Pi” for M.Tech 1st and 2nd year students.
9. One day workshop on “ Introduction to Embedded C” for B.Tech students.

# Knowledge Dissemination

## Hackathons: ** In collaboration with MEK, DIC, Intel projects

1. Organized **Hardware Hackathon** during the Techfest of IGDTUW in April 2016 on the topic "Smart Campus Monitoring System".
2. Organized **Hardware Hackathon** during the Techfest of IGDTUW in October 2016 on the topic "Home Automation".

## Conferences Organized: ** In collaboration with MEK, DIC, Intel projects

1. Organized **National Conference on Product Design 2016** along with MSRIT, Microsoft, Intel which was held in Bengaluru in June 2016.

## Research Showcase: ** In collaboration with MEK, DIC, Intel projects

1. Organized Research Showcase 2016 held at CSE Department, IGDTUW

## Media: ** In collaboration with MEK, DIC, Intel projects

1. Invited and attended Live Interview in "Good Evening India", Door darshan for the theme "Women Entrepreneurship".
2. My Smartphone kit featured in EFY [Electronics for You] Magazine.
3. My smartphone Kit got featured in "The Hindu".

## Acknowledgements Received: ** In collaboration with MEK, DIC, Intel projects

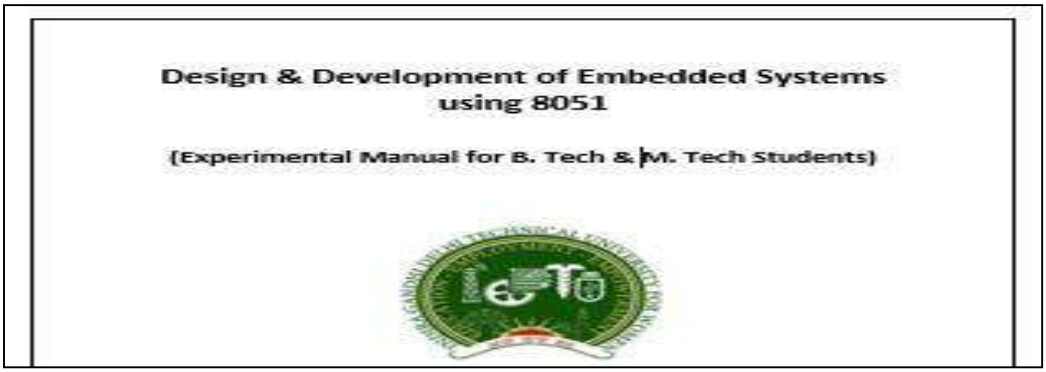
AnshumanTech Pvt Ltd had acknowledged the book and Manuals of "My Smartphone Kit" and designed their own kit on the same lines.

## Collaborators:

1. ***Academia:*** SRKR engineering College, IIT Delhi, MSRIT Bengaluru, JSS Mysuru, NITTTR Chandigarh
2. ***Industry:*** Microsoft, Intel, DIC(MHRD), Narnix Techno labs Pvt Ltd, Trinity Microsystems.

# CURRICULAR IMPACT Highlights – Manuals:


Design & Development of Android Based IoT Application using Snapdragon Board




Embedded System Programming

**Note:- For All Lab Manual ecopy available in our Website. Kindly visit this below link**
**http://www.mobileeducationkit.net/labmanuals**

* In collaboration with other projects

# OUTREACH & SOCIETAL SENSITIVITY

## Training Programme

The Innovators lab offers comprehensive training and education programs to meet the needs of research scholars , interns and students involved in the conduct of research at IGDTUW. These programs are structured to provide a better understanding of the requirements, policies and processes that help in motivating students to carry out their innovations.

## Classroom Training

Classroom based training involves small activities that students have to complete in groups , the main goal of having classroom based training is to make students learn skills like team work , group discussions , decision making etc. Thus apart from learning technical skills classroom training help to develop personality development skills too.

* In collaboration with other projects

# OUTREACH & SOCIETAL SENSITIVITY

Conducted workshop at IGDTUW, Delhi

STP, IGDTUW, Delhi


Workshop embedded system design Oxford university, Delhi

Conducted FDP at SV university, Tirupati

## Summary

Designing and developing inspiration have always play a key role in the success of any venture. “ITRA- Human Sense: towards context aware sensing, inference and actuation for application in Energy and healthcare.” project has given this great opportunity to various researchers and students at IGDTUW.

ITRA :Human Sense provided various support in the improvement of lab structure. These developments and improvements lead out towards the practical approach to support courses taught in classes. Frequent workshops and competitions were also conducted to expertise the learning capabilities of students and to provide exposure to the real implementation environment. The experimental outcomes are framed in lab manuals, are also mentioned on the website via the collaboration with other projects( MHRD DIC, MEK, INTEL).

The researchers in ITRA:Human Sense have also provided various opportunities to explode out different environments, to carry out surveys and to design and deploy the prototypes at different areas. The great support by ITRA lead out in about completion of their work. Various publications and patents are also carried under ITRA.

Apart from all IGDTUW Administration and Finance Department along with other collaborated partners supported a lot in running this project successfully in the campus.

We have immense pleasure in successful completion of this project.

# Gallery


DR. M.S. RAMAIAH CENTRE FOR RESEARCH & DEVELOPMENT
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