# VISHAKH DUGGAL

ROBOTICS ENGINEER

## PROFILE

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## SOCIAL

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## PROFESSIONAL STATEMENT

Seeking challenging opportunities in the field of Robotics System Development and to be part of an exemplary growing organization where performance and teamwork are well recognized.

## EXPERIENCE

| | |
|---|---|
| Present | **International Institute of Information Technology, Hyderabad** <br> Masters in Computer Science and Engineering <br> *Pursuing M.S with Robotics as major area of research.* |
| 2011 - 2013 | **ABB** <br> Robotics Engineer <br> Robotics System software development for Next Gen Industrial robots including system software prototyping, design and development. |
| 2010 - 2011 | **STMicro Electronics** <br> System Engineer <br> Prototype development of Android based set-top box system. |
| 2007 - 2010 | **NXP Semiconductors** <br> Senior Software Engineer <br> Linux device drivers and boot-loaders development for digital TV. |
| 2007 - 2007 | **Conexant Systems** <br> Design Engineer <br> Design and prototyping Verilog code on FPGA. |

## EDUCATION

| | |
|---|---|
| 2013 - Present | **Masters, Computer Science and Engineering** <br> *International Institute of Information Technology, Hyderabad*    CGPA 9.67 /10.0 |
| 2003 - 2007 | **B.TECH, Computer Science and Engineering** <br> *Bharati Vidyapeeth's College of Engineering, Delhi* <br> First class with distinction, 75.08% |

## PROFESSIONAL SKILLS

| | | |
|---|---|---|
| C/C++ | | Computer Vision |
| Python | | Machine Learning |
| Matlab | | Image Processing |
| OpenCV | | Linux Drivers |
| CUDA | | Boot-Loaders |
| ROS | | Optimization |

## Techinical Profienciency

- Perl and Shell Scripting

- OSX, Ubuntu and Windows.

- GDB , GIT , SVN tools.

- ARM9, MIPS Processors

- 8051 Microprocessors

- UART and I2C protocols

- U-Boot boot loader.

- Linux  Kernel and Drivers

- Android Multimedia Stack

- Support Vector Machine (SVM)

- Deep Learning

- Convolutional Nueral Network

- Computer Vision

- Theano and Lasagne Python

- Caffe  Machine Learning Tool

# HARDWARE  PLATFORMS

- ✓ Arm 32bit and 64 bit based SOC
- ✓ MIPS 32 bit based SOC
- ✓ Intel Core i5/i7 processors
- ✓ SH4 based SOC
- ✓ Nvidia Titan X GPU
- ✓ 8051 microcontroller
- ✓ ABB Industrial Robot Controller

# SOFTWARE  PLATFORMS

- ✓ Windows 7 OS
- ✓ Linux Kernel development
- ✓ Linux device drivers development
- ✓ U-Boot bootloaders
- ✓ Android OS development
- ✓ Android OS multimedia framework
- ✓ ABB Controller Software
- ✓ CUDA  7.0

# PROFESSIONAL  SKILLS

- ✓ Experience in leading software development team of 5-10 developers.
- ✓ Industrial 6yrs + experience in embedded system software development.
- ✓ Drafting system software requirements, architecture design, prototyping, documenting, developing product level software development and testing.
- ✓ System level software design and development from firmware, bootloader and linux platform development to high level python and C/C++ based API design, developement and software integration.
- ✓ Industrial robotics system software design and development with enhanced Network Security.
- ✓ Project proposal development with requirement analysis, system design, time and cost estimation, hardware / software platform selection, project milestones and delievery estimations.
- ✓ Technical expertise in emerging technologies : Robotics, Machine learning and Computer vision.
- ✓ Product developement, completion and delievering including costumer onsite interaction and requirements gathering.
- ✓ Android OS and multimedia stack development along with board bring-up experience.
- ✓ Hardware and software debugging using JTAG and GDB.
- ✓ Secure boot based embedded system design and development.
- ✓ Parallel programming using CUDA 7.0 over Nvidia GPU including software development, testing and benchmarking.
- ✓ Linux kernel, device drivers and bootloaders development experience along with system optimization over hetrogeneous hardware platforms.

## CERTIFICATION

**IELTS    2013**
8.0 / 9.0

**GATE    2012**
98.02  Percentile

## ROBOTICS RESEARCH

✓ Development of ROS package and software programming interface for Parrot™ Bebop Drone and would soon be release to Open Source.

✓ Development of proprietary autonomous navigation framework for quadcopter utilizing GPS and visual SLAM for state estimation.

✓ Knowledge and expertise of 2D/3D localization, Robotic vision, Machine learning and numerical optimization.

✓ Real Time Control System (RCS) framework and library development expertise.

✓ Trajectory planning and control design and development experience for flying drones.

✓ Optimizing execution of code using CUDA and OpenMP.

✓ Expertise with Matlab, OpenCV, OpenNI and Python based development.

✓ Experience with information fusion using Extended Kalman Filter.

✓ Deep learning and SVM based machine learning projects.

## ROBOTICS PROJECTS

**2014 - 2015    Renault-Nissan Overtaking Manoeuvre for Autonomous Vehicle**

This sponsored research project by Renault-Nissan focussed on developing autonomous overtaking manoeuvre for vehicles. The project demonstrated the effectiveness of developed algorithm on TORCS and UC/Win simulators. The developed algorithm utilized non-linear time scaling and velocity cone based collision detection. Publication based on the work was accepted in IVS 2015.

**2012 - 2013    Controlling ArDrone2.0 using Hand Gestures**

ArDrone2.0 flying drone's motion is controlled using hand gestures of the user. The gestures are detected using ASUS XtionPro™ motion camera and OpenNI software with motion commands provided to drone over Wifi. Multiple gestures could be detected using motion camera. Interface to drone was created using C++ and integrated with motion camera.

**2012 - 2013    Background Alteration of Live Video**

Live video from camera is processed in real time with foreground (user) and background detection. Background is replaced with newer image with framework working at each video frame as user motion may change at each frame . This project was operationalized to under the basics of video processing.

**2006 - 2007    Speech Controlled Robot**

This required both firmware and hardware development. The system consisted of 8051 microcontroller as main controller and HM2007 speech recognition IC along with other peripherals over PCB. Design, prototyping and manufacturing of PCB  was done in-house. The micro-controller was programmed to communicate with HM2007 and operate the robot according to predefined motion commands. The robot was designed in the form of robot car operated using battery power.

2006 - 2007    **Automatic PCB Drilling Machine**

Simple but effective PCB drilling machine was developed based on concept of dot matrix printers. 8051 micro controller based solution was developed and it was interfaced with UART port of PC. Drilling positioning information is provided over UART to 8051. PCB is fixed statically in machine and overhead drilling machine is positioned in X and Y direction using dot matrix ribbon based control.

# P R O F E S S I O N A L   R E S E A R C H

2010 - 2011    **Navigation in Android using IR Remote**
*STMicro Electronics*

Android 2.3 was ported on Set-top box based on SH4 CPU platform of STMicro. Prototype was developed and user interaction was provided through interfacing IR remote on Android.
- ✓ This required developing IR remote controller drivers over Android kernel.
- ✓ User space application developed in C++ to capture such keys events and mapping it to predefined GUI interface commands of Android.
- ✓ Activity of Android based Set-top box was "first" known prototype developed.

2009 - 2010    **Optimizing Boot-Time of Linux Powered Embedded System**
*NXP Semiconductors*

Digital TV powered by Linux had requirement of reduced boot time for better user experience. This required full system overview for Optimization, with first being the UBoot Boot-loader.
- ✓ UBoot was initially cleaned for unwanted code to reduce its footprint and speedup its execution.
- ✓ Linux kernel was optimised with its drivers configuration with some drivers moved from static to dynamic loading to **reduce Linux kernel 2.6 Image size by 10%.**
- ✓ User application launch was changed based on "Required at Startup" or "Not immediately required". All there measured helped in reducing boot-time from **34 sec to 18 sec**.

2008 - 2009    **Secure Boot Optimization in Asymmetric Multiprocessing Embedded System.**
*NXP Semiconductors*

Secure Boot signifies verifying authenticity of software modules using digital signature before being launched. This was implemented boot-loader onwards including Linux kernel and user applications.
- ✓ Digital signature based authentication was implemented using **SHA1 and AES**, which are computationally expensive. Shifting computationally expensive operations to GPU mitigated increased boot-time due to authentication.
- ✓ The CPU and GPU communication was achieved using **shared memory** and **hardware semaphores**. Application was developed in C and integrated into bootloader and Linux kernel.

# PROFESSIONAL PROJECTS

**2012 - 2013**  **Next Generation Robot Platform Software**
*ABB*

Next Generation software platform for ABB industrial robots with scalability, maintainability and multiprocessing capabilities inbuilt. Responsibilities in project:

✓ Software shift from VxWorks to Linux based system.
✓ Design, prototyping and development of 3$^{rd}$ party software modules installation and management software on Robot using python.
✓ Development of PC and Robot interface protocol based on HTTP data transfer.
✓ C# interface design and development for GUI to interface with the Robot.
✓ Boot-time reduction of system by switching from UBIFS to JFFS file system. This reduced the boot-time from 24sec to 18 sec.
✓ Developing procedure for updating flash memory based Root File system of booted Linux system → Initially RAMFS based file system is loaded in RAM and kernel RAMFS pointer is diverted to the new RAMFS. Using automated scripts flash based RAMFS is updated without any conflicts.

**2011 - 2012**  **Android Based Set-top Box**
*STMicro Electronics*

Development of Set-top box prototype based on Android 2.3 OS. Project modularity were:

✓ Porting Android 2.3 OS to SH4 based Set-top box hardware.
✓ Development of IR Remote controller driver and interfacing with Android OS.
✓ Integrating STMicro proprietary multimedia interface HAVANA with Android framework.
✓ Extending Android multimedia framework to accommodate HAVANA features.

**2009 - 2010**  **SD Card based Embedded System Development**
*NXP Semiconductors*

Linux based embedded system was required to be shifted to SD card from Nand Flash as primary system storage. The primary development responsibilities:

✓ Modifying and configuring Uboot to support SD card.
✓ Configuring Linux kernel and adding driver support for SD card.
✓ Developing new upgrade image for SD card based on NXP proprietary PFF format.
✓ Shifting system to EXT4 for current Nand Flash based JFFS2 file system.
✓ Performance and stress testing of the system.

**2009 - 2010**  **SD Card Interface and Supporting Infrastructure Development for Embedded System**
*NXP Semiconductors*

This project required development of SD card support for the embedded systems. The project development activities included:

# PERSONAL DETAILS

**Date of Birth**

23/06/1985


**Sex**

Male


**Languages**

English

Hindi

- ✓ Pre-development study of various modules of system that may get affected due to shift to SD card.
- ✓ Micro boot-loader and Uboot Boot-loader development to support SD card interface.
- ✓ Study of current partition management system on Nand Flash and its respected formatting tools.
- ✓ Development of module in boot-loader to support new MBR and EBR based partition table.
- ✓ Modification of PFF (Philips File Format) structure to incorporate SD card based images.
- ✓ Development of tools to generate MBR and EBR based partition tables, to be flashed while updating the system.
- ✓ Development of UBoot based GUI upgrader for SD card based system.

2008 - 2009    ### System Upgrader Using Uboot BootLoader
*NXP Semiconductors*

This project required development of Uboot boot-loader and UART based instead of JTAG supported system upgrader.  The development activities included:

- ✓ Development of micro boot-loader supporting UART and XModem protocol.
- ✓ Developing scaled down version of U-Boot boot-loader with support for upgrading the system.
- ✓ Developing configurable state machine to read flash image from USB and upgrade the system.
- ✓ Developing UBoot based GUI interface for providing feedback to user while updation of system is in progress.

2007 - 2008    ### Development of Linux Device Drivers
*NXP Semiconductors*

Development and maintenance of Linux device drivers for the embedded system. The responsibilities included:

- ✓ Development and maintenance of I2C driver for embedded system.
- ✓ Bug fixing and adding support for new board in the driver.
- ✓ Maintaining Nand flash driver of the system.

## AWARDS AND RECOGINITIONS

- ✓ Awarded prestigious SAKURA Science scholarship from Government of Japan and visited Hiroshima University in 2015.

- ✓ Best Performer award, NXP Semiconductors, 2009.

- ✓ Best Team performance award, NXP Semiconductors, 2008.