# **VINEET SHARMA**

# Seeking an assignment with an organisation of repute

#### PROFILE

- Technology Consultant with vast and diverse skills set; 4.5+ years experience of inter disciplinary Research & Development, Proof Of Concept (PoC) & Rapid Prototyping, Product Development in domains like Internet of Things (IoT), Smart Devices, Personalized Health Care, Automotive, Smart Home (Automation).
- Lead IoT Spice Ventures Pvt. Ltd. into the verticals of Internet of Things (IoT) in Medical, Smart everyday devices, Point of Sales (PoS).
- Worked for Iglyte AMS Pvt. Ltd., started the IoT department in stealth mode which lead to the creation of IoT Spice Ventures Pvt. Ltd.
- Worked as Software Engineer for L&T Infotech for Innovation Labs.
- Worked as a Research Engineer for The Indian Institute of Technology, Bombay (IIT-B).
- Worked as an Independent & Individual Consultant to Emprog Inc., headquartered in Silicon Valley, CA (USA).
- > Contributed towards FafadiaTech Pvt Ltd (a 5 year old start-up) venture into Electronics and Embedded Systems
- Committed, innovative and passionate individual with ability to continuously learn and face challenges head on.
- Result-oriented approach and problem solving ability with exceptional communication and interpersonal skills.
- Techno Management with ability to comprehend the business requirements and a knack of delivering quick result oriented solution that affect the bottom line.

#### **CORE COMPETENCIES**

Research and Development	Embedded Systems Design
Proof of Concept Design	Electronic Circuit Design & Simulation
Rapid Prototyping	Circuit Implementation
Project Management	Software Development and Testing
System Architecture	Product Design & Development
Core Team Building and Mentoring	Industrial Design & Automation
Algorithm Design	CAD Design and 3D Printing
Design Thinking	Computer Vision
Market Feasibility Research	Machine Learning
Market Feasibility Research	Machine Learning
Mobile App Development	Development of Server Backend and APIs
Startup Funding Strategy	Techno Management

#### **TECHNICAL SKILLS**

	Machine Learning	:	Supervised Learning (Naive Bayes, Support Vector Machine (SVM), Decision Tree, Random Forest, Regression), Unsupervised Learning (Clustering K Mean)
$\geqslant$	IoT Tools/Platforms	:	Node Red
$\triangleright$	Voice Assistant (Integration)	:	Alexa, Siri
≻	Single Board Computers (SBC)	:	Raspberry Pi 3, Beagle Bone Black, Raspberry Pi Zero W
$\triangleright$	SBC Operating Systems	:	Raspbian Stretch, Stretch LXQT, Diet Pi, OpenMedia Vault, Win 10 IoT
	Microprocessor/Microcontroller	:	Intel Curie SoC, ARM Cortex M4 (Texas Instruments Tiva C TM4C123G), ARM Cortex M4 (Nuvoton M53 - M453VG6AE), ESP 8266 Node MCU,ESP 32, ATMega 328, ATTiny 2313, ATMega 32u4, ATMega 8535, 8085, 8086, 8051 and its derivatives.
	Sensors/Peripherals	:	Hall Effect Sensor, 3-axis Accelerometer, Temperature-Humidity Sensor, SD Card, 16x2 LCD, 3-axis Joystick, Photo resistors, Ultrasonic PING Sensor, PIR Motion Sensor, 10 Degrees Of Freedom (3-axis Digital Compass, 3-axis Accelerometer, 3-axis Gyro, Atmospheric Pressure), Quadrature Wheel Encoder, Bluetooth, EEPROM, Rotary

			Encoder, Motor Drivers, Servo Motors, Line Sensors, Piezo Electric
			Ceramic Sensor, Door Sensors, Real Time Clock, 433 Mhz Ask
			Transmitter/Receiver, Zigbee S2, Flex Sensor, Alcohol Sensor, Pressure
			Sensor, SIM900, Neo Pixel, Bluetooth Low Energy (nRF 8001), Heating
			Pad, Blood Pressure Module, Pulse Sensor, ECG, Optical Reflectance
			Sensors, Ambient Light Sensor, RGB Light Sensor, Luminosity Sensor,
			IR Reflectance, Capacitive Touch Pads, I/O Expansion MCP23017, ESP-
			01 Wifi Module, GPS, Raspberry Pi CSI Camera, Logic Level Converter.
			Nordic nRF24L01 Transceiver, Sonoff.
$\triangleright$	Data Communication Protocols	:	UART. I2C. SPI. BLE Protocol Stack. MQTT.
$\triangleright$	Communication	:	Mobile Communication – GSM and CDMA, Network communication.
$\triangleright$	Programming Languages	:	Python, C, Embedded C, C++, Java, Visual Basic, Assembly Language
	5 5 5 5		programming with Turbo Assembler (TASM).
$\triangleright$	Web Application / Framework /	:	Django, Django REST, RESTful API, Flask (Python Frameworks),
	SDKs		Postman REST Client, MicroStrategy v10 SDK, OpenCV.
$\triangleright$	Web Technologies	:	HTML, XHTML, CSS, WAMP, JavaScript, jQuery, Bootstrap.
$\triangleright$	Mobile Development	:	Android App Development.
$\triangleright$	IDEs	:	Emprog's ThunderBench, Eclipse, CodeBlocks, WinAVR, Keil C, Turbo
			C++, Arduino, Processing, Energia, Keil MDK, Android Studio.
$\triangleright$	Miscellaneous	:	Cygwin, MingGW, GNU toolchain, SolidWorks (CAD for 3D Printing),
			,Sublime Text 3, X-CTU, Notepad ++, Virtual Box
$\triangleright$	Scientific Computing	:	Matlab, Scikit Learn
$\triangleright$	Electronics Design/Simulation	:	Xilinx, MultiSim, Proteus
$\triangleright$	Printed Circuit Board Designing	:	ExpressPCB, Eagle
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#### WORK EXPERIENCE

#### **Technology Consultant**

February 2017 - Present

(Clients include startups and established companies)

#### **Key Deliverables**

- Determining the Client's requirement.
- Advising on suitable Technology, Solutions and suggesting the Scope of Work.
- Techno Management, Planning Time Lines and Carving the Roadmaps.
- Research and Development, Proof of Concept (PoC), Rapid Prototyping and developing the agreed Solution.
- Product Design and Iterative Development, System Integrations.
- Debugging, Optimization and Technology Upgrades of the existing Solution.
- Providing key insights on technology, process and project execution that enables the Client to make educated and efficient Business Decision.

#### Highlights

• Providing technology based consultancy services in the verticals like Internet of Things (IoT), Automotive, Health Care, Smart Devices, and Smart Home Automation.

#### IoT Spice Ventures Pvt. Ltd., Mumbai

Senior IoT Engineer

#### **Key Deliverables**

- Techno Management, Project Management, Team Building and Mentoring, Design Thinking, Market Feasibility Research.
- Research & Development (R&D), Proof of Concept Designs and Rapid Prototyping, Algorithm Designs, System Architecture.
- Product Design and Iterative Development, Circuit Design and Fabrication, System Design and Integration, Programming.

September 2016 - February 2017

# Projects (Refer Annexure-B for project details)

• Lead IoT Spice and working on Smart Personalize Heath Care devices for Medical Adherence and Point of Sale Solutions.

Iglyte AMS Pvt. Ltd., Mumbai

IoT Engineer

February 2016 - August 2016

August 2015-January 2016

## Key Deliverables

- Research & Development (R&D), Proof of Concept Designs and Rapid Prototyping.
- Product Design and Iterative Development, 3D Printing.
- Circuit Design and Fabrication, System Design and Integration, Programming.
- Creation of Custom Bluetooth Low Energy (BLE) Profiles, Services and Characteristics.
- Feature enhancement of the existing product and demonstration to plausible clients.

# Highlights

• Worked on projects on Medical Adherence and Point of Sale in the domains of Internet of Things which lead to the creation of IoT Spice Ventures Pvt. Ltd.

## L&T Infotech, Pune (for Innovation Labs)

Software Engineer

## Key Deliverables

- Research & Development, Proof of Concept and Feature Development.
- Iterative enhancements for Innovation Labs products

## Projects

- Worked on research and development of features for Innovation Lab's report migration tool called *RKonvert*. *RKonvert* is used for report migration among the popular Business Intelligence (BI) tools like Micro Strategy (MSTR), Cognos, and Business Objects (BO) etc.
- Developed features using Java and Micro Strategy SDK v10

# Indian Institute of Technology, Bombay (IIT-B)

**Research Engineer** 

September 2014 – August 2015

#### Key Deliverables

- Research & Development (R&D), Proof of Concept Designs and Rapid Prototyping.
- Product Design and Iterative Development, 3D Printing.
- Circuit Design and Fabrication, System Design and Integration, Programming.
- Recruitment and Mentoring.

# Projects (Refer Annexure-C for project details)

- Worked on Biotechnology Industry Research Assistance Council (BIRAC) Biotechnology Ignition Grant (BIG) Project for making affordable Arterial Pulse Analyzer (APA). APA won the Ericsson's Networked India Innovation Challenge (among 154 nominations pan India) and was featured on CNN IBN.
- Networked India YouTube Channel : https://www.youtube.com/watch?v=-TUqpY65dbI
- Worked on other personalized health care devices and wearable, Smart everyday consumer objects, Internet of Things (IoT).

# Highlights

• Evolved as an Intrapreneur - with sound comprehension of technology as well as business aspects; and a knack of getting things done quickly to expedite time to market.

# Emprog Inc, Silicon Valley, USA

Individual and Independent Consultant

# Key Deliverables

- Research & Development (Software)
- Feature Development and Integration in C, Jave SWT Plug-in Development.
- Target Specific Device database update and creating patches/updates for OpenOCD Debuggers
- Quality Control of Emprog's flagship product ThunderBench for ARM

# Projects

- Implemented a memory monitoring utility for Emprog's flagship product- ThunderBench for ARM. It calculates the size of RAM & ROM utilized for storing the user application CODE and DATA based on the ELF file generated at the end of the Build Process. The memory utilization details are then displayed as *percentage used* format for both RAM and ROM.
- Implemented a feature that imposed memory restriction on the user CODE size. It was used to create an Educational Version of ThunderBench.
- Worked briefly on developing an Eclipse SWT based Plug-in for ThunderBench.

# Elance, Online Freelance Market Place

Consultant (Freelancer)

August 2014 https://www.elance.com/s/vineetsharma14/

# Project:

- Designed a Power Electronics Circuit for a Remote Control System. Provided with necessary consultation to develop and integrate the system in the existing infrastructure.
- https://www.elance.com/s/vineetsharma14/job-history/?t=1

# FafadiaTech Pvt. Ltd., Mumbai

Embedded Engineer

# Key Deliverables

- Rapid prototyping of the ideas, visions and requirements proposed by the company.
- Research and determine the technology for the project.
- Coding the applications, algorithms and API as required for the project.
- Testing the reliability and demonstrating the functional prototype.
- Implement any enhancements or modification suggested by the company.
- Making the prototypes production grade/ready.

# Highlights

- Played a major role in leading the company to venture into totally new areas of Electronics and Embedded Systems.
- Instrumental in creating functional prototypes from any idea/ blue print /requirement given.
- Evolved as a professional with good comprehension for various aspects of business.

# Major Projects Accomplished (Refer Annexure-D for project details)

- Self Balancing Robot Platform
- Delta Robot
- Swarm Robotics
- Home Automation controlled by iOS and Andriod app
- Pomodoro Timer (Productivity analysing and enhancing device)
- Fatigue Science

June 2013 – June 2014

#### ACADEMIA

- B. Tech Electronics Engineering from Veermata Jijabai Technological Institute (VJTI), Mumbai in 2011 and secured CPI 7.7/10
- Diploma in Electronics and Tele Communication Engineering from Babasaheb Gawde Institute of Technology (BGIT), Mumbai in 2008 and secured 87.84% - 11<sup>th</sup> Rank in State

#### EXTRA MURAL ENGAGEMENTS

- > Pursuing online course of "Introduction to Machine Learning" from UDACITY (Dec 2017 to Present)
- > Pursuing online course of "Developing Android Apps" from UDACITY
- Successfully completed an online course on ARM Cortex M Microcontroller "Embedded Systems Shape the World" with HONOR CODE CERTIFICATE, offered by University of Texas - Austin through edX, in May 2015.
- Certification in Core Java from NIIT in 2007
- Implemented the numerous projects as Pet Projects and weekend hobby projects: (*Refer ANNEXURE-A and E for project details*)

## **REFERENCES AVAILABLE UPON REQUEST**

## **ANNEXURE-A**

# Pet Projects (with an objective of research and exploration of technology) :

## Title: Smart Garden Monitor using ESP 8266 Node MCU and Node Red

**Description:** The project is build around ESP 8266 Node MCU, which measures the Ambient Temperature, Humidity, Light Intensity, Soil Moisture Levels and communicates the values via MQTT at periodic intervals to an MQTT Broker configured on Raspberry Pi Zero W over WiFi. A Node Red distribution is also configured on the same Raspberry Pi Zero W, which enables graphical programming of various components. A dashboard designed on Node Red UI provides the real time measurements of the above mentioned parameters via a Web Interface. There is also a provision to trigger relays from the Digital Out Pins of Node MCUs for triggering Water Pumps for irrigation or drip irrigation. Since the communication to and from Node MCU is over MQTT, Alexa integration was possible in Node Red. Further integration is in process with inclusion of features like Database Backup on Raspberry Pi Zero and integration of other Voice Assistants like Siri and Google Home.

**Technologies/Concepts Used**: Raspberry Pi Zero W, Diet Pi, Node Red, Mosquitto MQTT Broker, ESP 8266 Node MCU, Arduino IDE, Analog Soil Moisture Sensor, DHT 22 Ambient Temperature and Humidity Sensor, LED for Output, Amazon Echo Dot, Voice Assistance Alexa.

## Title: ESP8266 Node MCU voice control from Alexa

**Description:** The project is build around ESP 8266 Node MCU with an aim of switching its pins HIGH and LOW via Amazon's voice assistant Alexa. The Node MCU is programmed with the Arduino and uses WifiUdp.h library for using UDP, so that the device can be discovered and commanded from Alexa. Multiple devices can be assigned to the various pins of Node MCU and each can be switched individually from Alexa.

*Technologies/Concepts Used:* ESP 8266 Node MCU, Arduino IDE, LED for Output, Amazon Echo Dot, Voice Assistance Alexa.

#### *Title:* Automating Hydroponics

**Description:** With the flexibility that Hydroponics provides like indoor farming in limited space constraints, use of less water for cultivation and most importantly no use of soil; the aim was to automate the process and mitigate the human intervention. So, the project uses off the shelve hydroponics kit which comprises of a pump to oxygenate the water for about 5 hours each day and requires replenishing of nutrients periodically. The project uses Sonoff WiFi Switch to periodically operate the pump. The levels of nutrients can be detected with an Electrical Conductivity (EC) Sensor and then can be programmed to replenishing the 3 nutrients accordingly. I am looking for a moderately priced EC sensor and Dissolved Oxygen Sensor as the commonly available sensors for this purpose are expensive. Additionally, the Temperature, Humidity are also monitored via ESP 8266 Node MCU. All the measure parameters are published to the MQTT Broker running on a Beagle Bone Black and integrated with Node Red. As the scale and the density of the hydroponics system increases additional monitoring of CO2 levels and Temperature and humidity of the room becomes import. The objective of this project is to have limited human intervention only during the initial setup of the system and during the final step of harvesting. Rest all the intermediate stages should be taken care of by the Automated System.

*Technologies/Concepts Used:* Hydroponics kit, ESP 8266 Node MCU, Arduino IDE, DHT11, Beagle Bone Black, Stretch LXQT, Mosquitto MQTT, Node RED, Sonoff Switch.

## Title: Network Attached Storage (NAS) on Beagle Bone Black

**Description:** The objective of this project was to explore the efficacy of a DIY NAS and its day to day usability for the Bandwidth Intensive Media Files. One of the aims was to set up a Plex Streming Media Server. An Open Media Vault distribution was used on Beagle Bone Black along with a 1 TB Externally Powered Hard Drive. The setup worked fine for smaller file, but was slow for larger files like video and backup achieve files. The reason was the limited speed supported by the old Rev A Beagle Bone Black's Ethernet Interface. So, it was functional but not usable with the older generation of Beagle Bone Black. It can be made usable with today's standard of larger media files by the use of a Single Board Computer (SBC) like the newer versions of Beagle Bone which support Gigabit Ethernet in place of the older Beagle Bone Black.

**Technologies/Concepts Used:** Beagle Bone Black (Rev A), Open Media Vault distribution for Beagle Bone Black, 1 TB Hard Drive, Cooling Fans etc

Title: Django Scheduler with RESTful APIs and Android Mobile App

**Description:** The objective of this project was to create CRUD (Create, Retrieve, Update, Delete) RESTful APIs and a task scheduler database which could be accessed from a Mobile App. The database schema which was programmed in Django Models was saved in the SQLite database. The Android App was using RESTful APIs along with the Basic Auth to provide user specific access to the database for the CRUD operations. Django Recurrence package is used to create recurring events similar to the functionality found in commercial task scheduling/calendar apps like Todoist and Outlook.

**Technologies/Concepts Used:** Django, Django REST Framework, Recurrences, Python, SQLite Database, RESTful (CRUD) API, Android Studio, Basic Auth.

#### ANNEXURE-B

## Projects accomplished for Iglyte Pvt Ltd and IOT Spice Pvt Ltd:

Title: Medical Adherence IoT Device "Pill Box"

**Description:** Pill Box is a portable, personalized medical device, which ensure medical adherence in patients with chronic diseases and in geriatric patients. It enables the patient to follow the prescribed medicine regime by keeping a track of their medication habits. The doctor can then track the adherence levels to the prescribed regime by his patients; and can intervene if frequent non adherence is observed. The pill box comprises of numerous sensor along with Microcontroller for Box Lift Detection as well as the Box Empty/Fill Detection for small individual dose medicine chambers. The device syncs with the Mobile App via the backend server over Wifi or GRPS. The device can sync directly with the Mobile App using BLE. The backend server does the analytics on the sensor data; and provides adherence level as well as patient's condition/symptoms/state of being -on the doctor's mobile app and the web based dashboard.

**Technologies/Concepts Used:** Arduino 101, Intel Curie, Bluetooth Low Energy (BLE), ESP 8266 (WiFi), Optical Sensors – LDRs and TCRT 1000, Limit Switches, IO Expansion MCP 23017, Batteries, Embedded C, Solid Works (for CAD Design), Mechanical Fabrication for Proof of Concepts (PoC), Multicolor LEDs, Buzzer etc.

## Title: IoT Point Of Sale (PoS) Scanner

**Description:** IoT PoS Scanner is an Optical Imaging device, intended for quick (within 5 sec) capture of Medical Prescription at the Chemist Store/Pharmacy. The device aims to document all the prescriptions for which the medicines are dispensed to the patients. The captured prescriptions images are enhanced compressed and are securely pushed to the Cloud for archiving. Each device uses a Unique Chemist ID to manage and organize the pushed images on the cloud. The PoS Scanner comprises of an off the shelf Web Camera and a Microcontroller with the added Switches and LEDs for user interactions and notifications respectively. The firmware on the Microcontroller handles all the user interaction and notifications. The python code is responsible for image capture, image optimization and compression, image naming and folder structuring, pushing on the cloud. There is also a stand alone, advanced version of this device in the research phase with advanced features like bar code and QR code detection etc.

**Technologies/Concepts Used:** Arduino Uno, Arduino Nano, Web Cam, Switches, Multi Color LEDs for Notification, Buzzer, Switching Circuits, Raspberry Pi 3, RPi CSI 5 MP Camera, Python, Open CV, Image Processing, Image Compression, Microcontroller, Embedded C, Solid Works(for CAD Design), Mechanical Assembly and Fabrication.

#### ANNEXURE-C

#### **Projects accomplished for IIT- Bombay:**

## Title: Arterial Pulse Analyzer

**Description:** It is a non invasive, low cost, portable medical device which can assist clinicians to diagnose the Cardio Vascular Diseases (CBDs) effectively. The hardware comprises of a microcontroller interfaced to a Bluetooth and a Piezo Sensor. The Piezo sensor's data is read and sent via Bluetooth to the Android App for logging and further analysis. The Android App computes the sensor's data and analyses the various parameters of the Arterial Pulse Waveform to infer the heart's condition.

**Technologies/Concepts Used:** Arduino Uno, Arduino Nano, Arduino Pro Mini, ATMega 328, Bluetooth, Piezo Sensors, Photoplethysmography Sensors, LiPo Batteries, Solid Works (for CAD Design), 3D Printing, Python, Embedded C, Processing.

Title: Vital Parameter Monitoring.

**Description:** It is a medical device which continuously monitors, logs and analyses the vital parameters like Blood Pressure, Heart Rate, ECG, Temperature and SpO2 levels (arterial oxygen saturation). It can serve as a low cost alternative to the expensive continuous monitoring equipments used in ICUs. In fact, it can provide ICU level continuous monitoring in the general wards. The system is designed around a microcontroller which is interfaced to a Bluetooth and numerous sensor modules. The data from the sensor modules are captured, processed and their respective parameter values are sent to an Android App via Bluetooth for further analysis and logging.

**Technologies/Concepts Used:** Arduino Uno, Arduino Mega, ATMega 328, ATMega 2650, Bluetooth, ECG Modules, Photoplethysmography Sensors, Temperature Sensor, Blood Pressure Module, Solid Works(for CAD Design), 3D Printing, Python, Embedded C, Timer based Multithreading on Microcontrollers.

#### Title: Smart Tag

**Description:** This project was a prototype to demonstrate the plausible applications and an opportunity to explore the features of BLE. The smart tag's hardware comprised of a microcontroller interfaced to a BLE Module (nRF 8001), Neo Pixel Ring and a Buzzer. The tag communicated with the Android App using the Bluetooth 4.0 protocol. The Received Signal Strength Indicator (RSSI) was measured at both the ends i.e. at the hardware as well as at the app. If the RSSI levels dropped below a specified threshold value based on the preset distance, then it indicated that the smart phone and the tags are separated beyond the specified distance. A buzzer was sounded along with visual display on the neo pixel ring - alerting the user to check if he/she has dropped/forgotten the smart phone or the item to which the smart tag was attached. This system/approach can be used for security of luggage, or for remembering the daily use items like keys, wallet, id cards etc.

*Technologies/Concepts Used:* Arduino Mega, ATMega 2650, Bluetooth Low Energy (BLE), Neo Pixels, Timer based Multithreading on Microcontroller, Embedded C.

#### Title: Neo Natal Thermo Regulation System

**Description:** This device is intended to be used in the neonatal care to monitor and prevent the onset of hypothermia in the newly born babies. The system uses a temperature sensor which continuously monitors the baby's body temperature. If the temperature falls below a threshold value, an SMS alert is send to the doctor. In the meantime, the device can take preliminary corrective actions to maintain the baby's body temperature by regulating the heating elements in the blanket.

*Technologies/Concepts Used:* Arduino Mega, ATMega 2650, Arduino GSM Module, Thermistor, Steinhart-Hart's Equation, Heating Pads, Closed Loop - Control System, Embedded C.

## Title: Vein Finder

**Description:** Vein Finder in an assistive medical device enabling a clinician to view the subcutaneous vein network in real-time in order to aid the process of vein puncture. The prototype was build around Raspberry Pi B+ with a RPi CSI Camera Module. An array of InfraRed LEDs of specific wavelength were used to irradiate the skin surface with IR Radiation. The fact that oxygenated blood absorbs the IR Radiation accompanied with Image Processing, enables the device to display the veins in real-time.

Technologies/Concepts Used: Raspberry Pi B+, RPi CSI Camera, IR LEDs, Image Processing, OpenCV, SimpleCV, NumPy, Python.

## Title: Sleep Monitoring System

**Description:** This system can be used as an assistive technology for detection and further understanding of conditions like sleep apnea, restless legs syndromes etc. that hamper the sleep quality. Numerous sensors like piezo, PPG sensor, microphone and accelerometer were interfaced to a microcontroller. The data from the microphone and PPG Sensor was fused for accurate detection of snoring. The accelerometer's data was used to detect the sleep patterns. All the data was streamed via Bluetooth to an Android App for logging and for further processing and analysis of these conditions.

**Technologies/Concepts Used:** Arduino Pro Mini, ATMega 328, Microphone, Piezo Sensors, Accelerometer, Breath Sensor, photoplethysmography sensor (PPG Sensor), Signal Conditioning, Bluetooth, Embedded C.

## Title: Spirometer:

**Description:** It was a prototype built with an aim of creating personalized spirometers for patients with chronic respiratory diseases. The hardware comprised of a microcontroller interfaced with a Bluetooth and a differential pressure sensor. The differential pressure sensor's input was strategically attached to the inlets of a 3D printed venturi tube. The pressure sensor's data was read and send via Bluetooth to an Android App. The flow rate was calculated by measuring the differential pressure sensor's output. The lung capacity was estimated from the flow rate and the time duration of the flow.

*Technologies/Concepts Used:* Arduino Pro Mini, ATMega 328, Differential Pressure Sensor(SPD102DAHYB), Bluetooth, Embedded C, SolidWorks (for CAD Design), 3D Printing.

#### Title: Dust Monitoring System

**Description:** The system provides a measure of dust concentration and the dust particle size in the ambient condition. This system is intended for use in medical facilities and clean rooms. In this system, an Optical Dust Sensor's output is read by a microcontroller and the results are displayed on a OLED display. The results are also send via Bluetooth to an Android App for data logging and further analysis.

**Technologies/Concepts Used:** Arduino Pro Mini, ATMega 328, Optical Dust Sensor (GP2Y1010AU0F), Bluetooth, OLED Display, Embedded C, LiPo Battery, SolidWorks (for CAD Design), 3D Printing.

#### Title: Smart Lock

**Description:** The Smart Lock started as a pet project and was inspired from Lockitron. The prototype comprised of a microcontroller interfaced with a Bluetooth and an Electronic Lock with the required power electronics switching circuit. The hardware communicated via Bluetooth to an Android App. The door could be locked/unlocked via the Android App. Additionally, the door could be locked/unlocked manually via a switch, so that it functions like a conventional lock as well.

*Technologies/Concepts Used:* Arduino Uno, ATMega 328, Electronics Lock, Bluetooth, Power Electronics, Embedded C.

#### ANNEXURE-D

## Projects accomplished for FafadiaTech Pvt Ltd:

## Title: Self Balancing Robot Platform

**Description:** Designed and implemented a Self Balancing Robotic Platform intended for Tele Presence Application. The Self Balance Robot is a closed loop system, which incorporates a PID controller to balance itself on 2 wheels. The robot constantly monitors its tilts angle with respect to the surface. The tilt angle is determined by processing the data from the 3 – axis accelerometer and the 3 – axis gyroscope (6 DOF). A Kalman filter recursively works on this tilt angle which is noisy to produce a reasonably accurate estimation of the tilt angle for the entire system, thereby mitigating the effect of noise. The robot standing vertically with respect to the surface is the Set Point for the PID Controller. Any deviation from this Set Point is corrected by forward / backward movement of the robot with an aim of reducing the error between the Set Point and the current tilt angle

**Technologies/Concepts Used:** Arduino Uno, ATMega 328, Motor Driver L293D, Johnson Geared Motors, 6 DOF, Kalman Filter, Tilt Angle and Gyro Rate, PID Visualizer for PID tuning, Ziegler–Nichols Method of PID tuning, Embedded C, Processing

# Title: Delta Robot

**Description:** Developed a prototype of Delta Robot. The Delta Robot is a parallel - link robot suited for repeatable tasks. It consists of 3 arms mechanically attached to 3 independent servo motors at one end. The servo motors move their respective arm and their coordinated movement causes the face plate (bottom end plate) attached the other end of arms to move in the Cartesian co-ordinates. A Processing code is used to provide a User Interface which translates the mouse movement to movement of the face plate. The processing code sends commands over serial link to the Arduino, which controls the 3 servo motors. Its intended application is generic platform for Pick and Place System, Vision Based Sorting System and various CNC applications like 3D Printer, Plotter and Cutter

# Technologies/Concepts Used: Arduino Uno, ATMega 328, Servo Motors, Embedded C, Processing

# Title: Swarm Robotics

**Description:** Designed Mobile Robot Units for the multi agent system. The system has distributed intelligence i.e. Low Level Intelligence in each robot and High Level Intelligence in the Back End Software that co – ordinates and commands all the multi agents via API calls over WiFi. The robots behave in a task centric manner, taking care of uncertainties of the changing environment. Numerous approaches have been tested to make the multi agents navigate in a deterministic manner, so that the Back End System can have seen of localization for each multi agent. Its intended application is Material/Warehouse Handling System

**Technologies/Concepts Used**: Histogram Algorithm, Quadrature Wheel Encoding, Line Followers, Digital Compass Navigation with tilt compensation, PID feedback control, Differential Kinematics, Arduino Yun, Arduino Uno

# Title: Home Automation controlled by iOS and Andriod app

**Description:** Designed and developed a Home Automation System, which can be integrated into the existing home/office electrical system to control 8 devices (any consumer appliance), open – close curtain/window blinds, and switching & speed regulation of the ceiling fan. The system can be accessed via a smart phone app. The smart phone apps (i.e. both Android and iOS) make REST API calls over Wifi for the intended switching operations. In response to the API calls, the REST Server sends switching command to the circuit interface to it. The circuit comprises of TRAICs, Opto Couplers, Zero Crossing Detectors for executing the switching operations

**Technologies/Concepts Used**: Microcontollers – ATMega328, ATMega32u4 and supporting circuitry implemented with various ICs and discrete components, FLASK (python framework), Jinja Template, Python, Embedded C, MultiSim, Arduino UNO, Arduino YUN, Raspberry Pi, REST API, Power Electronics – Switching and Phase Control

Title: Pomodoro Timer (Productivity analysing and enhancing device)

**Description:** Designed and implemented the Pomodoro Timer to track the productivity and also the number of times the person was interrupted in a pomodori (a single time slot). The data is periodically uploaded to the Google Spread Sheet for determining the patterns of high and average productivity. Another variant of code was also developed to save the data periodically on the SD card

*Technologies/Concepts Used*: Microcontroller ATMega32u4 with supporting circuitry, Arduino YUN, Temboo API, DS 1307 Real Time Clock, Embedded C, SD Card

## Title: Fatigue Science

**Description:** This project tracks the body movement to analyse the number of steps the person has walked through the span of time/day and the level of fatigue the person had. A functionality to trace the galvanic change occurring in the body in response to extreme fatigue, stress, height, deep sleep and many other parameters is being researched. The purpose of this project is to become aware of various triggering factors that affect the body's response and thereby affecting the well being, creativity and productivity

Technologies used: Microcontroller ATMega32u4, ATMega328, 3 - axis Accelerometer, and various sensors, Embedded C, SD card interface, Bluetooth, Arduino Yun, Arduino Uno

#### **ANNEXURE-E**

## Weekend/Hobby Projects:

*Title:* Bluetooth Low Energy (BLE) Protocol Stack

**Description:** The idea was to create a custom BLE Profile, Characteristics and Services which can be used for a multiple projects involving BLE and Smart Phone Apps. The Nordic nRF Master Control App for Android was used to read and write values to the BLE Services on the BLE Hardware.

Technologies/Concepts Used: Arduino IDE, Intel Curie, BLE Protocol Stack, Embedded C, Nordic nRF Master Control App.

*Title:* Node MCU communication with the Adafriut.io.

**Description:** The objective of this project was to explore the NODE MCU (ESP 8266 - 12E) as an Internet of Things (IoT) development platform, as well as the Adafruit.io as an IoT backend. A low cost temperature humidity sensor DHT 11 was read by the NODE MCU and the temperature and humidity data was pushed to the Adafruit.io using it's APIs.

Technologies/Concepts Used: NODE MCU (ESP 8266 -12E), Adafriut.io APIs, DHT 11, Embedded C.

*Title:* ESP 8266 + Arduino communicating with ThingSpeak.com

**Description:** The objective of this project was to interface ESP - 01 (i.e. ESP 8266 - 01), a low cost WiFi Module with Arduino. A simple Soil Moisture Sensor was read by Arduino and it's values were published to the channel on the ThingSpeak.com Server via it's APIs. To test ThingSpeak as a IoT Message Broker, publishing and subscription of the ThingSpeak Channels was concurrently done with a REST CLIENT named POSTMAN to make GET and POST Requests. JSON parsing was done to read the response from the ThingSpeak Server

*Technologies/Concepts Used:* Arduino Uno, ESP 8266 - 01, Thing Speak APIs, Soil Moisture Sensor, JSON Parsing on Arduino, Embedded C, POSTMAN.

*Title:* Object Detection using LDR.

**Description:** The objective of this project was to design an algorithm that enabled use of low cost sensor to accurately detect presence of an object. A low cost LDR with was interfaced to Arduino via a voltage divider. The value of LDR changed in context to the presence of object. Smart computation on the LDR's data was done to make an accurate prediction of the presence of the object. The algorithm is sensor agnostic. The same algorithm was used with photo transistors and it made the prediction accurately.

*Technologies/Concepts Used:* LDR, Arduino, Embedded C, Algorithm Design, Computation and Analysis of Sensor's data.

Title: Multiplexing Analog Sensor with Microcontroller

**Description:** The objective of this project was to interface/monitor many soil moisture sensors for the automatic irrigation/smart garden project. Two 74HC4067 (16 : 1 Analog MUX) were cascaded and interfaced with microcontroller to read more than 20 sensors. The monitoring algorithm was so designed that it could reference the sensor to be read by the sensor number. The mechanism of IC selection and select line configuration was encapsulated in private functions in separate modules.

*Technologies/Concepts Used:* Embedded C, Microcontroller, 74HC4067 Analog Mux ICs, Soil Moisture Sensors.

Title: Temperature – Humidity Telemetry via ASK

**Description:** DHT 11 (Temperature and Humidity Sensor) is interfaced to an Arduino, which periodically reads the temperature & humidity values and transmits them via a 433 MHz ASK Transmitter. On the receiving end, a 433 MHz ASK Receiver is interfaced with another Arduino. The transmission is received and the temperature & humidity values are extracted; and displayed on a 16 x 2 LCD Module interfaced

*Title:* Dial Type Electronic Code Lock

**Description:** A rotary encoder (shaft type with push button switch) is used for the user input and a 16 x2 LCD display is used for displaying the lock status and user's input information. The user can enter the passcode digits by rotating the shaft of the encoder. The passcode digits increment or decrement, when the encoder's shaft is rotated clockwise or anticlockwise respectively. The encoder's push button is used for entering the digits of the passcode as well as for interacting with various options of the LOCK

## Title: Door Activity Monitor

**Description:** A door sensor is interfaced to the Arduino, which detects whether the door is open or close. A count of the times the door is opened is maintained, in order to trace the activity signature. The Arduino then send the door's status as well as the count to nearby computer via Bluetooth. A processing code on the computer graphically displays the door's status and count

## Title: Cost Analysis Software

**Description:** Designed cost analysis software for a leading mechanical spares manufacturing firm. The front end (GUI) of the application was coded in Java. The backend database of the application was implemented using MySQL. The application calculated the cost of the selected items in accordance to the current price for the materials

## Technologies/Concepts Used: Java, MySQL

#### Academic Projects

Title: Smart Car System

**Description:** Smart Car System was a prototype to demonstrate plausible means to reduce the common traffic related problems like accidents, rash driving, and violation of rules. In addition, various safety features like theft protection and notification to the traffic control room in case of an accident were also demonstrated. The project was build around 89C51 microcontroller with integration of various sensors and peripherals

#### Title: Electronics Code Lock

**Description:** Electronic Code Lock project was based on the 89C51 series of microcontroller which was interfaced with a 3x3 matrix keypad for entering the lock/unlock code and a 2-line LCD screen to display the instruction and the current state of the lock. Software incorporated features like master password, system lock when wrong code entered 3 times

## Title: Speed Control of DC Motor using Internet

**Description:** Speed Control of DC Motor using Internet was a prototype to demonstrate the innumerable application and possibilities of tele operation. The project was a blend of Hardware and Software. The software for the project was written in VB 6.0 and used 'WinSock API' for communication.