Akhilesh Moghe   Senior Engineering Lead

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An Agile-Result-oriented software engineer focused on the Architecture, Design and implementation of IoT/Edge device/Cloud applications for devices updates & data management. Successfully delivered 2 IoT projects in last 3.5 years with AWS IoT, Azure IoT, Ayla IoT, Mender.io platforms on ARM, x86 & STM32 devices. Overall, 10 years of IT services & Product development experience in IoT, Cloud & Multimedia domains.

Software Development:
Broker Architecture,   Client-Server Architecture,   Multithreaded-Multiprocessor-distributed Applications, Agile,   Test Driven Development,   Design Patterns,   REST,   Service Oriented Architecture
Technologies Frameworks:
NodeJS,   Robot Operating Systems (ROS1 & ROS2)
Cloud Platforms:
AWS,   Azure,   Ayla IoT Platform,   Firebase,   PubNub,   Mender.io
AWS Cloud Services:
AWS IoT,   Greengrass,   Robomaker,   Lambda,   Kinesis,   API Gateway,   SNS,   S3,   EC2,   EKS,   IAM
Azure Cloud Services:
Azure IoT Hub,   IoT Edge,   Device Update,   Azure Stack Hub,   ML Deployment,   Storage,   Container
Programming Languages:
C,   C++,   C++11,   Python,   JavaScript,   Shell Script
IoT Protocols:
MQTT,   D-Bus,   DDS,   ZeroMQ,   AMQP,   Serial,   MAVLink,   RTSP,   HTTPS
Multimedia Formats:
H264, **VP8 codecs**, **WebM** Packetizer, **WebRTC** Framework
Databases:
MongoDB,   MongoDB Realm,   InfluxDB,   SQLite
Build Tools, *Continuous Integration*, *Continuous Deployment:*
Make,   CMake, **Git,   Docker,   Kubernetes**, **Ubuntu Snaps**

Soft Skills: *Attention to details,   Connecting the dots,   Analyzing and inferencing,   Time Management, Communication,   Teamwork,   Technical Blogging,   Presentation,   Effort Estimations*

Experience:
- Senior Engineering Lead at Persistent Systems (Oct 2021 – Present)
- Engineering Lead at Persistent Systems (Jan 2019 – Sept 2021)
- Module Lead at Persistent Systems (Jan 2016 – Dec 2018)
- Senior Software Engineer at Persistent Systems (June 2014 – Dec 2015)
- Software Engineer at Persistent Systems (July 2011 – May 2014)

Education:
- **Post Graduate Diploma in Embedded Systems and Design**
  Centre for Development of Advanced Computing (CDAC), Hyderabad
- **B.E. in Electronics and Telecommunication**
  Rashtrasant Tukadoji Maharaj Nagpur University

Projects:

1. **Edge IoT Framework primarily for Life Sciences Use-cases**
   - ➤ **Role:** Solutions Architect (3 Months)
   - ➤ **Accomplishments:**
     - Currently evaluating ***AWS Outpost***, ***AWS EKS***, ***Kubernetes***, Containerized deployments, ***Apache Kafka***, ***Pravega***, Scalable ***MQTT brokers*** deployment to address <u>high volume sensors</u>, <u>high-definition video</u> data use-cases in <u>***5G***</u> <u>Edge Computing</u> scenarios.
     - Worked on common ***Edge IoT use-cases***, various possible scenarios considering data flows, data types, data restrictions, privacy, latency, bandwidth consumptions, connectivity restrictions, etc., primarily revolving around Life Sciences projects and devices.
     - Evaluated Open-Source Edge Projects such as ***KubeEdge***, ***ioFog***, ***EdgeX, LF-Edge*** Umbrella projects against identified use-cases.
     - Evaluated suitability of ***AWS IoT Greengrass*** and ***Azure IoT Edge*** + other ***AWS/Azure on-premises services*** for various Edge computing scenarios, presented pros & cons of both public cloud platforms and created various possible use-cases architecture/design with AWS/Azure as primary components of framework.
     - Architecting a common framework based on open-source Edge projects which can complement the public cloud services in on-premises Edge computing scenarios.

2. **NVIDIA Jetson Nano based Healthcare IoT Device as a Guided Pipetting Tip Sensing System**
   - ➤ **Role:** Systems Engineer (6 Months)
   - ➤ **Accomplishments:**
     - Carried out PoC tasks like ***flashing boards*** to simulate mass flashing at factory.
     - Multiple PoCs to understand *customizing* ***RootFS***, ***Secure Boot***, ***Bootloader Splash Screen***.
     - Interfacing ***Bluetooth module*** with NVIDIA L4T BSP software for <u>*Jetson Nano*</u>. All these PoC tasks resulted in a concrete plan to be executed at factory manufacturing.
     - Evaluated, Designed and implemented <u>*Firmware update*</u> and <u>*OS update*</u> mechanism based on ***Mender-Yocto*** Open-Source project.
     - Designed and implemented device side ***C++ & Python***, ***RESTful*** HTTP protocol-based ***multiprocessor-distributed*** IoT connectivity application for features like <u>*device identity & registration*</u>, <u>*status*</u>, <u>*user-device association*</u>, <u>*certificates management*</u>, <u>*device shadow*</u>.
     - Evaluated different ***inter-process communication*** tools, ***RPC*** mechanisms as ***ROS1***, ***ROS2***, ***D-Bus***, ***ZMQ*** to Architect & Design multiprocessor-distributed application.

3. **STM32 MCU based Portable COVID-19 Diagnostic device kit**
   - ➤ **Role:** Firmware Developer (4 Months)
   - ➤ **Accomplishments:**
     - Designed and Implemented <u>*STM32F407*</u> based MCU ***firmware*** to achieve ***USB communication*** with Android app using ***Virtual COM Port***, ***Flash memory read/write*** and ***PWM generation***.
     - Created a dummy <u>*test application in Python*</u> to automate the testing of STM32 firmware.
     - Received "***[Bravo Award](#)***" For the delivering the project in <u>*3 months*</u>.
     - *<u>Client Received **$2 Million** funding to continue development based on our Project</u>*

4. **OTA Firmware Updates for a STM32 MCUs and full OS Updates for x86 carrier boards**
   - ➤ **Role:** IoT Developer (14 Months)
   - ➤ **Accomplishments:**

- Designed and implemented **custom bootloader** with **Dual bank** strategy for _STM32F407 MCU_ to achieve robust _Firmware update_ requirements. **MAVLink** communication protocol and _Signature & checksum verification_ were few of the other key features implemented.
- Designed & developed **C++ & Python** based **multithreaded multiprocessor-distributed** application to achieve **OTA firmware update** for multiple STM32 MCUs. **AWS IoT Jobs**, **Device Shadow**, **Secure communication** and UART based _serial communication_ were key features.
- PoC for **full OS image** and **Application update** using **Mender.io** Open-Sorce project. _Full OS OTA updates_ with Mender server hosted on EC2. Also, same kind of _updates with USB and over LAN_ were also achieved with local Python server.
- Evaluated and finalized **Ayla IoT platform** for early market release without full fledge cloud development. _Device provisioning_, _status_, _firmware updates_ to multiple devices, sensor _data streaming_ were key features achieved in _4 months duration_.
- Designed and implemented a **NodeJS module** for _Data Synchronization_ between device and cloud using **MongoDB Realm** and **MongoDB Atlas** cloud databases. Understanding of new platform and successful delivery was achieved in _3 months_.

5. **Drone-based Asset Inspection with AWS IoT Greengrass & AWS Robomaker Services**
   - ➢ **Role:** Robotics, IoT Developer (8 Months)
   - ➢ **Accomplishments:**
     - [Demos were successfully showcased at CERAWeek 2019 and AWS re:MARS 2019 events](#)
     - Understanding of the new to be launched or recently launched **AWS Services** like **Robomaker**, **Greengrass, AWS IoT** and their use-cases for Robotics projects were achieved in _3 months_ with demonstratable applications as an outcome.
     - **Robotics framework ROS** based **distributed application** had _Machine Learning_ features like _Rust and leakage detection models_ that were deployed with **AWS IoT Greengrass** to multiple devices as **NVIDIA Jetson TX2** (_drone_), _mobile robots_ and _x86 machines_. **AWS IoT device shadow** updates and **IoT Jobs** for _firmware update_ were also used.
     - **AWS Lambda** functions were deployed to AWS IoT Greengrass to run _ML inference_.
     - Robotics application was able to _capture and upload_ the **thermal** and normal **camera videos** to **AWS S3** buckets, which were consumed by **AWS Sagemaker** for Machine Learning training.
     - **NodeJS**, **JavaScript** based Web Application running on **AWS EC2** was developed to control Robots with commands, to trigger firmware updates, and to initiate ML training in Sagemaker.
     - Camera Live video streams were transmitted to **AWS Kinesis Video Streams** and the same were rendered on Web Application in **HLS format**.

6. **WebMeeting (Screen Sharing Application) for MAC and Windows**
   - ➢ **Role:** Backend Developer (26 Months)
   - ➢ **Accomplishments:**
     - Received "_**You Made a Difference Award**_" for the extensive work done in the initial phase of the project, which helped the team to scale up and gain Client's Confidence.
     - Understood the **Chromium Open-Source Project** relevant modules, build systems which can be reused to create a **cross-platform** (Windows & MAC) Screen Sharing application which used **VP8 video codec** and **WebM packetizer**. Demonstrated the key functionality of screen sharing in _3 months_.
     - Evaluated and **AWS S3**, Dropbox, Google Drive for _file sharing_ capabilities, but Client did not pursue another cloud platform and file share was implemented with Firebase & PubNub.

- Designed and developed ***HTTP transport module*** for _screen sharing data_ + _Chats_ + _File sharing_ modules with **Firebase** & **PubNub** cloud platforms.
- Later, it was developed into a full-fledged product with multiple browsers supports + Chat, file share, recording capabilities. _The core screen sharing product is still in production_.
- PoC application was developed for ***Image & Text Detection*** in screen share data using an open-source library.

7. **Porting WebRTC based GChat Application on Linux & Android Platforms**
   - ➢ **Role**: Backend Software Developer (20 Months)
   - ➢ **Accomplishments**:
     - _The product was successfully showcased in CES2012-13 by the customers_.
   - ➢ Responsibilities:
     - Set Top Box, ***TI BeagleBone, Panda ARM board bring*** up with Linux/Android OS images.
     - Building & Porting ***WebRTC*** code for different ***Linux, Android Set top boxes***.
     - Dealing with all kinds of compile and run-time errors on every platform.
     - Modifying WebRTC GYP build structure for integrating platform specific Codec and Camera Libraries.
     - Integrating ***H264 Decoder-Renderer*** APIs with WebRTC code.
     - Integrating/Testing Quanta and Maxim Camera modules in the applications.
     - Debugged ***H264*** Decoder, ***YUV-RGB Render*** modules for Linux, Android platforms.
     - Thorough Unit Testing & Bug Fixing.

8. **Robotics Device Management Effort Estimation & Proposal Creation based on Azure Cloud**
   - ➢ **Role**: Developer (2 Months)
   - ➢ **Responsibilities**:
     - Understand the Product Requirements
     - Understand various ***Azure IoT*** & other Cloud services and mapping them to Product Requirements.
     - Create an Overview ***ROS*** & Azure Cloud based ***Architecture*** using ***Docker Container***.
     - Create ***Docker Containerized ROS Demo applications*** running on x86 Linux machine accessing connected peripheral devices, file system.
     - Create ***complexity sheet*** with various modular tasks to arrive at an ***effort estimation***.
     - Coordinate with other Product teams involved.