Karan Chitkara

701-200-1689
karan.chitkara@outlook.com
https://www.linkedin.com/in/karan-chitkara-332384b2
https://scholar.google.com/citations?user=NtgsucYAAAAJ&hl=en&oi=ao

———————————————————————- **Summary** ———————————————————————

An accomplished Principal Software Engineer specializing in medical device software development, with expertise in software architecture, mobile and web application development, cryptography, and automation frameworks. Recognized for developing groundbreaking software solutions that power life-saving medical technologies while ensuring compliance with global regulatory standards such as FDA, TÜV and NMPA. A patented innovator, technical leader, and award-winning contributor with several high-impact software patents that have shaped the future of neurostimulation and medical software systems. Proven ability to design scalable architectures, optimize development lifecycles, and introduce automation strategies that accelerate regulatory compliance and product launches.

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———————————————————————- **Technical Skills** ———————————————————————

Programming Languages	C, C++, C#, Swift, Java, MySql, SqlServer, XML, JSP, Javascript, Kotlin, HTML
Frameworks	Bootstrap, KMM, Struts, JFramework
Design Patterns	FLUX, MVC, MVP, MVVM
Other software	Xcode, Android Studio, IntelliJ, Eclipse, Net Beans, Git, Jenkins, Visual Studio

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———————————————————————- **Job Experience** ———————————————————————

Principal Software Engineer, Medtronic plc,   **December 2021 –**
Present

Key Responsibilities & Contributions

1. Software Architecture & Design for Medical Devices
   - Architected scalable and modular software frameworks for Medtronic's Deep Brain Stimulation (DBS) systems, ensuring high performance, security, and compliance with medical regulations.
   - Led the design of cross-platform mobile architectures (iOS & Android) to standardize development, improve efficiency, and reduce maintenance overhead.
   - Developed common reusable software components, enabling multiple teams across Medtronic to leverage a unified development approach.

2. Leading Major Product Releases for DBS Therapy
   - Played a critical role in multiple major software releases, including the Sensight Directional Lead System and Adaptive Deep Brain Stimulation (aDBS).
   - Ensured successful deployment of DBS software solutions in several international markets, aligning with FDA (US), TÜV (EU), NMPA (China), and other regulatory bodies.
   - Led technical execution for new therapy programming features, improving clinical efficiency and reducing patient visit times.
3. Automation & Software Testing Efficiency
   - Designed and implemented automation frameworks that drastically reduced software validation cycles from months to days, enabling faster regulatory approvals.
   - Developed the Automation Runner Tool, which analyzes over 11 million lines of code and executes 20,000+ test cases automatically, streamlining the testing pipeline and reducing manual effort by 90%.
   - Integrated automated test execution with software requirements tracking, simplifying regulatory audits.
4. Security & Cryptography in Medical Software
   - Implemented cryptographic security protocols to encrypt patient data and secure device communication via Bluetooth Low Energy (BLE).
   - Ensured compliance with HIPAA, GDPR, and global medical data security standards through secure software design principles.
   - Developed proprietary encryption frameworks for Medtronic's next-generation neurostimulator devices, ensuring tamper-proof communication and patient data protection.
5. Cross-Functional Leadership & Collaboration
   - Worked closely with Systems, Human Factors, Risk, Reliability, and Firmware teams to ensure a smooth software development lifecycle (SDLC) from initial design to post-market release.
   - Led cross-team discussions to bridge the gap between software, hardware, and clinical engineering, ensuring software solutions align with real-world medical use cases.
   - Partnered with regulatory teams to provide technical documentation supporting global market clearances.
6. Mentorship & Technical Leadership
   - Mentored multiple junior engineers and interns, guiding them in software design, best practices, and Medtronic's regulatory software development processes.
   - Conducted technical interviews for full-time hires, ensuring that new talent aligns with Medtronic's engineering standards.
7. Innovation & Future Technology Research
   - Continuously researched new software technologies, bringing in modern tools, architectures, and best practices to enhance Medtronic's software development process.
   - Led exploratory research into AI-driven therapy optimizations and enhanced user interfaces for clinicians, aiming to further improve therapy personalization and ease of use.

Impact & Achievements
- Accelerated regulatory approval timelines by developing automation frameworks that reduced validation cycles from months to days.
- Improved efficiency for clinicians and patients by leading the Electrode Identifier feature, which automates electrode selection and titration, saving clinicians hours of programming time.
- Enhanced software security by implementing cryptographic encryption, ensuring Medtronic's medical devices comply with global data protection regulations.
- Significantly contributed to major DBS software releases, ensuring millions of patients worldwide have access to optimized and secure neurostimulation therapy.

Senior Software Engineer, Medtronic plc,   **July 2018 – December 2021**

1. Architected a Cross-Therapy Mobile Communication Platform
   - Designed and implemented a common platform to facilitate secure and reliable communication between Medtronic medical devices and mobile applications (Android & iOS).
   - Standardized data exchange, device pairing, and communication protocols, allowing multiple therapy teams to adopt a unified framework instead of building custom implementations.
   - Improved scalability and maintainability by implementing a modular, reusable architecture that significantly reduced development effort for new therapy teams.
2. Enabled Cross-Platform Development for Mobile Medical Applications
   - Designed and implemented a Kotlin Multiplatform (KMM)-based framework, allowing developers to write shared business logic for iOS and Android, reducing code duplication and accelerating feature development.
   - Provided common APIs and data models that therapy teams could use to focus on UI and therapy-specific logic rather than handling lower-level communication details.
   - Conducted architecture reviews and code consultations to ensure consistency and best practices were followed across therapy teams adopting the platform.
3. Increased Development Efficiency Through Code Reusability
   - By introducing a centralized communication stack, reduced the onboarding time for new therapy teams by providing well-documented SDKs, API guides, and example implementations.
   - Implemented a dependency injection framework to allow teams to integrate only the required components, ensuring lighter and more efficient mobile applications.
   - Designed automated test frameworks for the shared platform, ensuring high stability and compatibility before deployment across therapy applications.
4. Collaboration Across Therapy Teams & Medtronic Divisions
   - Worked with firmware and embedded systems teams to align mobile communication protocols with device-side implementations, ensuring seamless interaction.
   - Engaged with product managers and UX designers to define consistent mobile interactions for different therapy applications while maintaining a cohesive user experience.
   - Collaborated with offshore teams to ensure seamless integration of the platform across different therapy applications.

Key Achievements:

- Developed a foundational mobile communication platform, now adopted by multiple therapy teams across Neuromodulation department of Medtronic, eliminating the need for redundant development efforts.
- Reduced onboarding and development time for new therapy applications by providing a ready-to-use communication framework with built-in security and reliability.
- Enabled cross-platform development, allowing shared business logic between iOS and Android, reducing maintenance overhead.

Software Engineer, Medtronic plc,   **Jan 2017 – June 2018**

1. Developed Android Application for Medical Device Therapy
   - Designed and implemented a mobile application for Deep Brain Stimulation (DBS) therapy, enabling clinicians to configure and manage neurostimulation therapy for patients.
   - Integrated secure Bluetooth Low Energy (BLE) communication protocols for device connectivity, ensuring reliable real-time interaction between mobile apps and medical

devices.

- Applied best practices in Android development, ensuring performance optimization, low-latency communication, and a seamless user experience for clinicians.

2. Implemented Scalable Software Design Patterns
   - Utilized MVC, MVP, and FLUX architectural patterns to develop a modular and maintainable software structure, improving code reusability and scalability.
   - Ensured separation of concerns, making it easier to integrate new features while maintaining system stability.
   - Conducted code refactoring and performance optimizations, enhancing the app's responsiveness and resource efficiency.

3. Automated UI Testing & Screen Capture for Validation & Compliance
   - Developed an automation tool to capture and document application screens, reducing manual validation efforts for regulatory approval.
   - Enabled automatic logging of UI elements, providing engineers and regulatory teams with structured documentation for software verification.
   - Reduced manual labor for validating UI consistency, optimizing time and cost for software testing and compliance audits.

4. Software Testing & Quality Assurance
   - Created and implemented unit tests and automated testing frameworks to ensure high code quality and system reliability.
   - Designed end-to-end test cases for application workflows, covering edge cases, performance tests, and security assessments.
   - Integrated continuous testing methodologies, enabling faster debugging cycles and enhanced application robustness.

Key Achievements:

- Developed core mobile application components, laying the foundation for future advancements in Medtronic's therapy software.
- Optimized BLE communication protocols, improving device pairing speed and data exchange reliability.
- Automated UI validation processes, significantly reducing manual effort and expediting regulatory compliance approvals.
- Improved code modularity using scalable design patterns, ensuring long-term maintainability and extensibility of the software.

Associate Software Engineer, Medtronic plc,   **April 2015 – December 2016**

1. Bug Fixes, Software Stability, and Quality Assurance
   - Diagnosed and resolved critical software defects in Android-based medical applications, improving system reliability and user experience.
   - Conducted root cause analysis on complex issues, reducing recurring software failures and improving debugging efficiency.
   - Wrote unit tests and automated test scripts, ensuring software quality and preventing regressions in future releases.

2. Feature Development & Software Enhancements
   - Contributed to feature development for Medtronic's Android applications, implementing key UI components and business logic.
   - Supported senior and principal engineers in designing and enhancing mobile application features, aligning with user needs and medical device functionality.
   - Developed application workflows, improving clinician interactions with Medtronic's mobile software ecosystem.

3. Collaboration & Cross-Team Coordination
   - Worked alongside firmware, backend, and testing teams to ensure seamless integration of software components.
   - Assisted in code reviews, debugging sessions, and software planning meetings, gaining hands-on experience in the medical device software lifecycle.
   - Coordinated with project managers and stakeholders to refine feature requirements and ensure timely software delivery.

Key Achievements:

- Resolved critical software defects, improving system stability and reducing software failures.
- Developed key Android application features, supporting the broader software architecture.
- Built automated test cases, increasing code coverage and reducing manual verification efforts.
- Collaborated across teams, gaining in-depth exposure to the end-to-end medical software development process.

Software Developer, Open Access Technology Inc.,   **January 2014 – March 2015**

1. Software Development & Issue Resolution for Energy Industry Applications

   - Diagnosed and resolved over 150 real-world software issues, enhancing the reliability of enterprise applications used in the power industry.

   - Optimized existing power trading and energy generation software, ensuring higher efficiency and improved performance for clients.

   - Applied object-oriented programming principles to refactor and improve code quality, reducing technical debt.
2. Full-Stack Development & New Feature Implementation

   - Designed and implemented new software modules using Web Plus, JavaScript, and C#, expanding system capabilities for power industry clients.

   - Developed interactive web applications, allowing energy providers to visualize and analyze power distribution data in real time.

   - Integrated backend and frontend components, ensuring seamless data flow between user interfaces and underlying databases.
3. Database Development & Optimization Using SQL Server

   - Created complex stored procedures, views, and functions to process large volumes of energy transaction data efficiently.

   - Designed SQL queries and indexing strategies to improve database performance and retrieval speeds for time-sensitive power grid calculations.

   - Optimized data management workflows, ensuring accurate and real-time energy forecasting.
4. Algorithm Development for Energy Trading & Unit Commitment Optimization

   - Worked on an advanced C++-based computation engine that interacted with SQL Server databases to solve unit commitment problems.

   - Developed algorithms to optimize energy generation planning, helping power providers minimize costs while meeting energy demand efficiently.

   - Implemented load-balancing techniques, improving energy distribution efficiency across multiple regions.

Key Achievements:

- Fixed over 150 critical software defects, improving system reliability and stability for the power industry.
- Developed new software features, enabling energy providers to manage power trading and distribution more effectively.
- Optimized database performance, reducing query execution time and improving system responsiveness.
- Worked on a complex energy optimization engine, applying C++ data structures and algorithmic problem-solving.

Java Programmer, Distance and Continuing Education, NDSU   April 2012 – December 2013

1. Designed and Developed a Web-Based Course Proposal System
   - Created a web-based application to digitize and streamline the course proposal approval process, replacing the previous paper-based system.
   - Developed backend services in Java, enabling faculty and administrators to submit, track, and manage course proposals online.
   - Reduced administrative overhead by automating approvals, data entry, and report generation.
2. Full-Stack Development & Database Management
   - Built interactive front-end interfaces using HTML 5.0, CSS 2.0, and JavaScript, ensuring a user-friendly experience for faculty and staff.
   - Designed and implemented a MySQL 5.1 database schema, optimizing data storage, retrieval, and security.
   - Wrote efficient SQL queries to fetch, store, and update course information dynamically, ensuring data consistency.
3. Data Validation & Business Logic Implementation
   - Developed server-side validation mechanisms using Java and Struts 1.3 framework, ensuring data integrity before database submission.
   - Implemented role-based access controls, ensuring only authorized users could approve or modify course proposals.
   - Automated data processing tasks, reducing manual intervention and improving response times for approvals.
4. Collaboration & System Integration
   - Worked closely with faculty, administrators, and IT teams to gather functional requirements and ensure the system met institutional needs.
   - Integrated the system with existing university databases, allowing seamless data synchronization across multiple departments.
   - Provided technical documentation and training to administrative staff, ensuring smooth adoption and transition to the new platform.

Key Achievements:

- Developed and launched a fully functional course approval system, eliminating the need for manual paperwork.
- Optimized database operations, improving query performance and data retrieval times.
- Enhanced system security with validation and access control mechanisms, ensuring reliable and accurate course data.
- Reduced administrative workload, allowing faculty to submit and track proposals more efficiently.

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Patents – Recognized Innovations in Medical Device Software

Inventor of multiple patented technologies that have introduced transformative advancements in neurostimulation and medical device software. These patents have been cited by industry leaders and influence cutting-edge developments in medical technology.

1. US12144637B2 – Brain Stimulation and Sensing - https://patents.google.com/patent/US12144637B2/en?oq=1.US12144637B2
   - Developed a novel system for optimizing therapy delivery and monitoring brain signals, enabling real-time adjustments for neurostimulation therapy.
   - Recognized as a key contribution to precision therapy programming for medical professionals.
2. US11986663B2 – Offline Session Review & Interactive Programming for Medical Devices - https://patents.google.com/patent/US11986663B2/en?oq=US11986663B2
   - Designed an offline data review system that allows clinicians to analyze therapy adjustments and patient response history without direct device connectivity.
   - This innovation enhanced clinical workflow efficiency, reducing session time and improving treatment personalization.
3. US11571576B2 – Brain Stimulation and Sensing - https://patents.google.com/patent/US11571576B2/en?oq=US11571576B2
   - Created an advanced interface for analyzing brain activity and stimulation parameters, integrating automated signal processing for optimized therapy adjustments.
   - Directly impacts adaptive deep brain stimulation (aDBS) systems, paving the way for more intelligent, personalized treatment solutions.
4. WO2025029593A1 – User Interface for Electrode Sensing Results in a Medical Device System (Pending) - https://patents.google.com/patent/WO2025029593A1/en?oq=WO2025029593A1
   - Designed an intelligent and interactive software interface for displaying electrode-specific neural sensing results in a deep brain stimulation (DBS) system.
   - Enables clinicians to evaluate signal quality across various electrode combinations using time-aligned signal traces and graphical overlays, improving decision-making for therapy configuration.
   - Facilitates streamlined programming workflows and reduces trial-and-error by ranking signal fidelity for faster, more data-driven electrode selection.
5. WO2025029591A1 – Electrode Ranking and Configuration Scoring for Medical Device Programming (Pending) - https://patents.google.com/patent/WO2025029591A1/en?oq=WO2025029591A1
   - Invented a software system for automatically scoring and ranking electrode configurations based on neural signal metrics such as amplitude, frequency, and stability.
   - Integrates data visualization, configuration filtering, and signal classification into a single interface, enabling clinicians to identify the most effective stimulation paths without manual trial-and-error.
   - Supports faster, repeatable, and evidence-based programming decisions in DBS therapy, accelerating clinical workflows while increasing treatment consistency and precision.

Awards – Recognition of Excellence in Engineering & Innovation

Medtronic Technical Contributor of the Year Award (2024)
- Awarded to less than 1% of Medtronic's global workforce, recognizing engineers whose work has had a substantial impact on medical technology.
- Recognized for leading the software development of the Electrode Identifier, a breakthrough technology that automates therapy adjustments, drastically reducing clinician workload and enhancing patient outcomes.

Medtronic Sensight Award – Successful Delivery of a Critical Project
- Awarded for delivering the Sensight Directional Lead System, an advanced neurostimulation system deployed in multiple global markets.
- Played a pivotal role as Software Lead, overseeing architecture design, cross-team collaboration, and verification frameworks to ensure seamless regulatory approval and launch.

Director's Award – College-Level Achievement
- Highest distinction awarded at the university level for exceptional academic and project-based contributions in software development.
- Recognized for outstanding leadership in software engineering projects and technical innovation.

Award for Excellence in Mathematics – High School Achievement
- Honored for exceptional problem-solving skills and mathematical reasoning, demonstrating early aptitude in algorithmic and computational thinking.

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——————————————————————— - **Education**———————————————————————

Bachelors	Masters
North Dakota State University, Fargo, ND *Masters of Science, Software Engineering*, December, 2014	**North Dakota State University**, Fargo, ND *Bachelor of Science, Computer Science*, May, 2012

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——————————————————— **Masters Research Project** ———————————————————

Overview & Research Problem

In an era of information overload, organizations, businesses, and researchers rely heavily on opinion mining (sentiment analysis) to extract insights from large-scale textual data. However, most existing sentiment analysis systems present results in static, unstructured formats, making it difficult for users to interpret data relationships, trends, and context at multiple levels.
The research aimed to bridge this gap by developing an interactive visualization system that enables users to explore multi-layered sentiment data dynamically, improving interpretability and decision-making in fields such as market research, customer feedback analysis, and social media monitoring.

Key Contributions & Technical Implementation

1. **Designed & Developed an Interactive Visualization System**
   - Created a hierarchical, multi-level visualization framework that allows users to drill down from high-level sentiment trends to detailed opinion clusters.
   - Developed dynamic graphs, heat-maps, and interactive charts, enabling real-time exploration of opinion mining results.
2. **Natural Language Processing (NLP) for Sentiment Categorization**
   - Implemented text processing algorithms to extract key topics, sentiments, and contextual cues from large datasets.
   - Applied statistical techniques to quantify sentiment intensity, allowing for a more granular view of user opinions.
3. **Full-Stack Development of the System**
   - Backend: Implemented in Java, leveraging text mining libraries for sentiment classification.
   - Database: Designed a MySQL-based structured storage system for opinion mining datasets.
   - Frontend: Developed a responsive web-based interface using JavaScript, HTML5, and CSS3, integrating D3.js for real-time visualization.
4. **Enhanced Usability with Interactive Filters & Multi-Level Navigation**
   - Enabled users to refine sentiment analysis results based on time periods, keywords, and polarity strength (positive, neutral, negative).
   - Introduced dynamic keyword search & filter functionality, making it easier to derive actionable insights from large data volumes.

Impact & Applications

- **Improved Decision-Making for Businesses & Analysts**
  - Helped organizations quickly interpret sentiment trends, improving customer feedback analysis and strategic planning.
- **Enhanced Academic Research in Sentiment Analysis**
  - Provided a novel approach to visualizing opinion mining results, making sentiment analysis more accessible to non-technical users.
- **Scalable & Extensible for Future Research**
  - Designed with scalability in mind, allowing for integration with social media datasets, product reviews, and large-scale opinion analysis platforms.

https://library.ndsu.edu/ir/items/26ccb6c8-49d4-48b2-bfe6-de238735c3db

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