VCU College of Engineering

304 Capital One Incident Wizard Design Report

Prepared for

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Capital One

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Date 10/8/24

Executive Summary

Capital One agents face growing challenges in managing a high volume of customer incidents, leading to delayed resolutions and reduced customer satisfaction. To address this, a Chat AI bot has been implemented to streamline the incident-handling process. This AI Chatbot is designed to increase the efficiency of agents not only in submitting incidents but also in ensuring null or unnecessary incidents are not sent into ServiceNow.

In this project we are creating an AI Tool that streamlines the process of creating customer incidents onto ServiceNow. Currently, Capital One agents are required to manually transfer data from their Capital One Environment onto the third-party service called ServiceNow. ServiceNow is a cloud-based platform that provides IT service requests and customer service management. Capital One agents uses ServiceNow to create “incidents” which are issues that cannot be solved by the agent. The agent must manually fill in all the necessary data for the incident so that it is all transferred onto the third-party platform. This transfer of information loses a lot of the contextual information that could help in the solution of the incident therefore causing most incidents to be ignored or deemed unsolvable by the developer processing the incident request. This is where the AI Incident Tool comes in. This tool would allow against to easily and efficiently transfer ALL data onto the ServiceNow Platform. This would allow the agent to provide higher quality customer service, allow less garbage incidents to put into ServiceNow, and allow engineers to spend more time on incidents that are actually able to be fulfilled due to the extra contextual data.

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Section A. Problem Statement

The problem that we are addressing is that creating ServiceNow incidents is a tedious process that affects an agent's efficiency. By cutting out some steps using the AI Chatbot we can effectively increase productivity, and quality of customer service.

Some problems that we want to solve with our AI Tool are as follows:

- How can we increase the efficiency of agents using the AI Chatbot?
- How can we improve quality of customer service using the AI Chatbot?
- In what ways can we make the AI interactive with the agent?
- How can we increase the efficiency of the engineers accessing the incidents on ServiceNow?

Unmet Engineering Needs:

- There isn't a system for creating incidents for ServiceNow. Currently it is all manual with the agent.

Who is affected by the problem at hand?

The issues that we are trying to find solutions for mainly affect the agents, the customers and the engineers. Because of the lack of an efficient system/tool to streamline the process, the agents and engineers are bogged down by the manual process of creating and troubleshooting the incident leading to lower efficiency and quality in turn affecting the customer's satisfaction.

Field of Study and Industry Context:

This project falls under the field of artificial intelligence (AI) and its application in the customer support and IT service management (ITSM) industries. The use of AI-powered chatbots to assist in routine tasks, such as troubleshooting and incident management, has gained prominence in recent years, driven by the growing need for efficiency and automation in large organizations. Chatbots can reduce the time spent on repetitive tasks, improve customer satisfaction, and enable support agents to focus on more complex problems.

In the context of ITSM, platforms like ServiceNow are critical for managing incidents, service requests, and changes within organizations. However, the process of creating, categorizing, and submitting incidents often remains manual, leading to delays and inconsistencies. This project aims to improve these workflows by integrating an AI-driven chatbot into the incident management process used by Capital One agents.

Sponsor Company and Relevance:

Capital One, a major financial institution, relies heavily on efficient IT operations to ensure seamless service delivery to its customers. The project is aligned with Capital One's broader objective of leveraging AI to optimize internal workflows. The chatbot will interface with

ServiceNow, a widely used ITSM platform, to assist agents in solving issues, reducing human error, and ensuring that incidents are categorized and submitted accurately.

Historical Perspective and Previous Solutions:

The application of AI in ITSM is not a new concept. Companies such as IBM have developed AI systems like Watson that assist in problem diagnosis and resolution. These systems have been successful in reducing response times and improving ticket resolution. Similarly, AI chatbots such as IPsoft's Amelia have been used to handle customer service interactions, demonstrating the feasibility and benefits of integrating AI into service management.

However, while these systems have seen success, they often lack customization for specific workflows or industries, or they focus more on customer-facing applications rather than internal IT agent support. The proposed chatbot aims to address these gaps by providing a solution specifically tailored to Capital One's incident management process. By combining conversational AI with domain-specific knowledge, the chatbot will assist agents in real time, potentially reducing the time spent on incident resolution and improving data consistency across the board.

Competitive Landscape and Prior Solutions:

There are several commercially available solutions that tackle IT service management automation, such as ServiceNow's own virtual agent, which helps users navigate the platform and create incidents. However, this virtual agent is often generic and does not provide deep insights into the context of a company's unique IT structure.

This project proposes an alternative design that will build upon existing technologies but with a focus on customization for Capital One's needs. By incorporating advanced natural language processing (NLP) and machine learning models, this AI chatbot will improve the incident submission process and ensure that agents are better supported in their tasks.

Improvements Over Previous Solutions:

Existing chatbots and AI systems in ITSM generally automate the submission process but do not offer robust troubleshooting capabilities that would help agents solve issues prior to submission. This project's chatbot not only aims to automate the creation of incidents but also provides relevant suggestions based on historical incidents and solutions, enabling agents to resolve incidents faster and more accurately.

This tailored, interactive experience ensures that Capital One agents can address incidents more efficiently, ultimately contributing to greater productivity and reduced downtime.

Section B. Engineering Design Requirements

This section describes the goals and objectives of the AI Incident Wizard project, outlines the design specifications and constraints, and identifies the relevant code and standards that will guide the development process. The design requirements are defined from the needs of Capital One's customer service operations, with a focus on improving incident management and enhancing overall service quality.

B.1 Project Goals (i.e. Client Needs)

The primary goal of this project is to enhance the efficiency and quality of customer service at Capital One through the implementation of an AI incident Wizard. By addressing the current challenges faced by agents, the project aims to streamline incident management and reduce unnecessary workload. The specific goals include:

- **Improve Agent Efficiency:** Enables agents to focus on customer interactions without the distraction of manually creating incidents.
- **Reduce Unnecessary Data:** Minimize the creation of voided incidents to optimize data storage and management.
- **Enhance Incident Resolution:** Provide agents with AI-driven solutions to resolve incidents promptly, improving overall customer satisfaction.
- **Utilize agent feedback :** Presents incidents to agents before transfering unresolved incidents to ServiceNow, ensuring timely follow-up and resolution

B.2 Design Objectives

The design of the AI incident Wizard will be guided by key objectives that outline what the system will accomplish. These objectives will be SMART- Specific, Measurable, Achievable, Realistic, and Time-bound. The design objectives include:

- **The design will enable agents to submit incidents through an intuitive interface, ensuring ease of use and accessibility.**
- **The design will integrate AI capabilities to facilitate quick decision making.**
- **The design will iInclude a feedback mechanism that allows agents to rate AI suggestions ensuring continuous improvement and quality.**
- **The design will be developed in a timely manner that allows for iterative testing and adjustments based on user feedback.**

B.3 Design Specifications and Constraints

- The design should respond to user input quickly (within 2-3 seconds)
- The design should integrate with ServiceNow's API
- The design should be able to handle at least 20 concurrent users
- The design should be able to maintain a 95%+ uptime
- The design should have username and password authentication at least
- The design should store data in a secure fashion using ServiceNow as a database
- The design should be within the given budget of $1000
- The design should streamline the incident creation process
- The design should allow incidents to be stored in ServiceNow without the agent leaving the service application they are already in

B.4 Codes and Standards

- OWASP Standards – design must validate user input and provide basic encryption
- Web Development Standards – design must work well across many browsers and screen sizes
- Software Testing Standards – design must include unit tests to validate key functions

Section C. Scope of Work

The project scope defines the boundaries of the project encompassing the key objectives, timeline, milestones and deliverables. It clearly defines the responsibility of the team and the process by which the proposed work will be verified and approved. A clear scope helps to facilitate understanding of the project, reduce ambiguities and risk, and manage expectations. In addition to stating the responsibilities of the team, it should also explicitly state those tasks which fall *outside* of the team's responsibilities. *Explicit bounds* on the project timeline, available funds, and promised deliverables should be clearly stated. These boundaries help to avoid *scope creep*, or changes to the scope of the project without any control. This section also defines the project approach, the development methodology used in developing the solution, such as waterfall or agile (shall be chosen in concert with the faculty advisor and/or project sponsor). Good communication with the project sponsor and faculty advisor is the most effective way to stay within scope and make sure all objectives and deliverables are met on time and on budget.

C.1 Deliverables

- Project Proposal - outlines the objectives, scope, methodology, and resource requirements for the Capital One Incident Wizard Program, serving as a blueprint to guide development and secure stakeholder approval.
- Fall Design Poster- visually summarizes the key elements of the Incident Wizard Program, including project goals, design concepts, and implementation strategies for presentation at events.
- Preliminary Design Report- details the initial design concepts, technical specifications, and chosen technologies for the Incident Wizard Program, evaluating feasibility and outlining next steps for development.
- User Interface Prototype: A functional front-end built with React, showcasing the incident management dashboard.
- Backend API: A Flask-based API for incident routing, data processing, and communication between the UI and internal systems.
- AI Model Integration: Implementation of OpenAI 4.0 for automated incident categorization and resolution suggestions.
- Workflow Automation: Integration of ServiceNow to automate ticketing, task assignment, and incident tracking.
- GitHub Repository: A GitHub repository with version control, including all source code, documentation, and setup instructions.
- Final Project Submission- fully developed solution, including the complete system implementation, documentation, and testing results.

C.2 Milestones

- Project Proposal - Oct 11
- Design Poster - Nov 15
- Preliminary Design Report - Dec 9
- UI Prototype - Feb 26
- Backend API - Mar 19
- AI Model Integration & Workflow Automation -Apr 30
- Github Repo & Final Project Submission - May 3

C.3 Resources

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- React - Enables a responsive and interactive UI, allowing users to track and manage incidents in real-time with efficient, reusable components.
- Flask - Provides a simple yet powerful backend for routing incidents, processing API requests, and integrating with internal systems for smooth operations.
- OpenAI 4.0- Automates incident categorization and prioritization using AI, offering intelligent resolution suggestions to reduce manual work and speed up the process.
- ServiceNow - Streamlines workflows by automating ticket creation, task assignments, and incident tracking, ensuring efficient management from start to finish.
- Github- Facilitates version control, collaboration, and continuous deployment, allowing teams to develop, review, and update the program without disrupting operations.

Section D. Concept Generation

A number of methods can be used to help generate design concepts from simple reflection and brainstorming, to working the problem backwards, using reverse thinking techniques, and looking to nature for inspiration (i.e. biomimicry). Existing solutions, or components of existing solutions, can be substituted, combined, adapted, modified, put to other uses, eliminated, or rearranged to meet new design objectives and specifications. A minimum of 3 overall design concepts is required for this section although more are welcome. Provide a brief description of how each design concept addresses the design problem. Discuss the potential pros and cons, including and potential risks of failure, of each of these concepts.

It is likely that each design concept may consist of several components. In this case, one or more of these components may offer a sub-problem that can be further explored, modified, or otherwise improved upon. These sub-problems may lead to the addition of several additional design concepts and may require the inclusion of a design concept chart or matrix to organize all ideas and potential solutions.

Provide any initial design sketches, drawings, 3D renderings, or conceptual models such as dataflow diagrams, process flows, etc. developed during the concept ideation phase. All hand drawings should be drawn to scale using basic engineering drafting tools (i.e. ruler, protractor, and compass). Geometric stencils can also be used to help produce quality hand drawings. Drawings should be presented in a profession manner, preferably done on engineering graph paper and using a high-quality scan. All sketches should be labeled to identify major components and different drawing views or projections if applicable. Basic dimensions should be provided to give a general sense of scale. Label each sketch or drawing with the name of the team member responsible for the sketch, the date it was drawn, and the drawing scale.

Section E. Concept Evaluation and Selection

Using a systematic decision-making process, evaluate each of the design concepts and choose the one that is most likely to succeed in meeting the design objectives and constraints. A Decision Matrix, or Pugh Matrix, helps to analyze alternatives, eliminate biases, and make rational decisions through thought and structure. First, work to develop a set of selection criteria for which to evaluate the previously generated design concepts. Selection criteria often include concepts of performance, cost, safety, reliability, risk, etc. Note that the selection criteria developed here will likely be more general than the project design objectives. As with the design objectives, conversations with the client help define appropriate selection criteria.

In many cases, the client may value the selection criteria differently, preferring that more emphasis be placed on some than others. In this case, weighting factors may be used to place more or less importance on the various criteria in the decision making process. Again, conversations with the client can be used to define criteria weighting factors. Often times, these conversations must be analyzed and interpreted by the team to determine which criteria are more important to the client and by how much. Feel free to discuss the assigned weighting factors with the client to see if they seem accurate.

Next, define an associated metric to represent each criteria. Metrics should be specific and quantifiable, providing numerical values that quantify the often vague concepts of the selection criteria. Metrics can be obtained, generated, or estimated through a number of methods including simple background research, preliminary design calculations, or basic analyses. Note that these metrics do not need to specifically align with the design specifications although there may be some commonality between the two. Provide a brief discussion of the rationale for selecting each of the assigned metrics.

Using the defined metrics, evaluated each design concept against all selection criteria by filling out a Decision Matrix. Design concepts can be compared by using simple rank scoring, raw scoring, or weighted scoring techniques and design concept with which to move forward can be selected. This type of process provides a meaningful, unbiased means for choosing a preliminary design concept prior to moving forward with more comprehensive, detailed analyses as provided in the design methodology section below. The results of this process should be discussed with the project client prior to moving forward with the selected design. Table 1 provides an example of a simple decision matrix.

Table 1. Example of a Decision Matrix.

	Design Concept A	Design Concept B	Design Concept C	Design Concept D
Criteria 1				
Criteria 2				
Criteria 3				
Criteria 4				
Criteria 5				
Total Score				

Note: Weights can be assigned to each criterion if desired.

Section F. Design Methodology

Provide a detailed explanation of the methods that will be used to help evaluate, improve, and evolve the design through the iterative engineering design process. Consider that ultimately, the final design must be verified and validated to ensure that it meets all of the previously developed and listed design objectives and specifications. Verification ensures that the design meets all specification, while validation confirms that the design functions as intended such to meet the client's needs. While it is common for initial design concepts to first be evaluated using simplified design criteria and metrics, the chosen design should be advanced, and later verified, using engineering calculations, computational models, experimental data, and/or testing procedures.

Use this section to describe any underlying physical principles and mathematical equations that govern the design. Provide details of any computer-aided modeling techniques used to evaluate the design including the software used, prescribed boundary conditions, and assumptions. Include a detailed description of any experimental testing methods including required testing equipment, test set-up layout, data acquisition and instrumentation, and testing procedures. If one or more prototypes is to be produced and tested, provide a detailed description of how each will be evaluated.

Note: The contents of this section are expected to vary from project to project. Subsections may be appropriate for providing details of analytical, computational, experimental, and/or testing methods. Some potential subsections that may be included in this section are provided. While critical design equations may be provided here, lengthy mathematical derivations may be included in an appendix. Validation procedures are critical and all projects should address such topic.

F.1 Computational Methods (e.g. FEA or CFD Modeling, example sub-section)

F.2 Experimental Methods (example subsection)

F.3 Architecture/High-level Design (example subsection)

F.5 Validation Procedure

Describe how the design team will validate that the final design meets the client's needs. This section should include a plan to meet with the client towards the end of the project to discuss final design details and demonstrate a prototype, experimental test, and/or simulation results. Provide a relative time frame for this validation to occur (e.g. "mid-March" or "early-April"). Include a brief discussion on how client feedback will be captured, such as a

formal survey, interview, or observation notes of the client using the prototype. It may also include plans to solicit feedback from other stakeholders and/or potential users.

Section G. Results and Design Details

Use this section to highlight the major results of the design methodology described above including important analytical, computational, experimental, modeling, assembly, and testing results. This section should be one of the most substantial sections of the report showcasing all of the hard work and effort that went into the completion of the final design and delivery of the project deliverables. Show how the identified problem was solved.

Highlight the prominent features of the final design through analysis results, modeling, drawings, renderings, circuit schematics, instrumentation diagrams, flow and piping diagrams, etc. to show that the design functions as intended and meets all design objectives and constraints. Overview designs such as dataflow diagrams, process flow, swim lane diagrams, as well as presentation-layer designs (e.g. storyboards for front-ends) should be included here. Detailed designs such as database designs, software designs, procedure flowcharts, or pseudocode should be included here. Support computational and experimental results with key plots and figures. All supporting figures should be clearly labeled and annotated to highlight the most important points of the figure (i.e. explicitly point out what the reader should focus on or understand about the image).

Note that while all results should be used to help inform design decisions, not all results may be necessary to include in the main body of the report. Extraneous supporting results (e.g. graphs, data, design renderings, drawings, etc.) that are not necessary for presenting the fundamental findings can be placed in one or more appendices. Detailed documentation of each program module can be provided as appendix.

G.1 Modeling Results (example subsection)

G.2 Experimental Results (example subsection)

G.3 Prototyping and Testing Results (example subsection)

G.4. Final Design Details/Specifications (example subsection)

Note that while the design constraints and specifications may have provided minimum or maximum values, or ranges or values, that the design needed to meet, the final design specifications should be listed here showing that the required design values were met. A list of final design details can also be included demonstrate fulfillment of the design objectives.

Note: Preliminary results should be included in the Preliminary Design Report to show the progress made of the selected design concept to-date. This section should be updated for the Final Design Report to include documentation of all of the work that was completed on the project throughout the entirety of the academic year.

Section H. Societal Impacts of Design

In addition to technical design considerations, contemporary engineers must consider the broader impacts that their design choices have on the world around them. These impacts include the consideration of public health, safety, and welfare as well as the potential societal, political/regulatory, economic, environmental, global, and ethical impacts of the design. As appropriate for the project design, discuss how each of these considerations influenced design choices in separate subsections. How will the design change the way people interact with each other? What are the political implications of the design? Does the technology have the potential to impact or shift markets? Does the design have any positive or negative effects on the environment? Don't forget to consider unintended consequences such as process or manufacturing byproducts. What impacts might the design have on global markets and trade? Are there any ethical questions related to the design?

While it is hard to forecast the various impacts of a technology, it is important to consider these potential impacts throughout the engineering design process. When considered during the early stages of the design phase, consideration of these impacts can help determine design objectives, constraints, and specifications and help drive design choices that may mitigate any potential negative impacts or unintended consequences.

Note: A minimum of 4 of these design considerations, including the consideration of public health, safety, and welfare, are required for the Preliminary Design Report while a section for all considerations must be included in the final design report.

H.1 Public Health, Safety, and Welfare

Provide a list of all design safety features and provide a brief description of each. Discuss the potential effects the design may have on public health, safety, and welfare. References to the codes and standards previous provided and the organizations that produced them may be summarized or referenced here.

H.2 Societal Impacts

H.3 Political/Regulatory Impacts

H.4. Economic Impacts

H.5 Environmental Impacts

H.6 Global Impacts

H.7. Ethical Considerations

Section I. Cost Analysis

Provide a simple cost analysis of the project that includes a list of all expenditures related to the project. If an experimental test set-up or prototype was developed, provide a Bill of Materials that includes part numbers, vendor names, unit costs, quantity, total costs, delivery times, dates received, etc. Do not forget to include all manufacturing costs incurred throughout the completion of the project. If the design is expected to become a commercial product, provide a production cost estimate including fixed capital, raw materials, manufacturing (including tooling and/or casting), and labor costs to produce and package the device. Note that this type of detailed cost analysis may be listed as a project deliverable.

Note: The Preliminary Design Report should include all costs incurred to date. It is expected that this section will be expanded and updated between the preliminary and final design reports.

Section J. Conclusions and Recommendations

Use this section to summarize the story of how the design team arrived at the final design. Focus on the evolution of the design through the use of the engineering design process including lessons learned, obstacles overcome, and triumphs of the final design. Revisit the primary project goals and objectives. Provide a brief summary of the final design details and features paramount to the function of the design in meeting these goals and objectives.

A discussion may be included to discuss how the design could be further advanced or improved in the future. If applicable, summarize any questions or curiosities that the final results/design of this effort bring to mind or leave unanswered. If this project might continue on as a future (continuation) senior design project, detail the major milestones that have been completed to date and include any suggested testing plans, relevant machine drawings, electrical schematics, developed computer code, etc. All relevant information should be included in this section such that future researchers could pick up the project and advance the work in as seamless a manner as possible. Documents such as drawings, schematics, and codes could be referenced here and included in one or more appendix. If digital files are critical for future work, they should be saved on a thumb drive, external hard drive, cloud, etc. and left in the hands of the project advisor and/or client.

Appendix 1: Project Timeline

Provide a Gantt chart of similarly composed visual timeline showing the start and end dates of all completed tasks and how they are grouped together, overlapped, and linked together. Include all senior design requirements including design reports and Expo materials (i.e. Abstract, Poster, and Presentation). All major milestones should be included in the timeline.

Appendix 2: Team Contract (i.e. Team Organization)

Copy and paste the content from the completed Team Contract here starting with Step 1 of the Team Contract and including all content following the ‘Contents’ list.

Appendix 3: [Insert Appendix Title]

Note that additional appendices may be added as needed. Appendices are used for supplementary material considered or used in the design process but not necessary for understanding the fundamental design or results. Lengthy mathematical derivations, ancillary results (e.g. data sets, plots), and detailed mechanical drawings are examples of items that might be placed in an appendix. Multiple appendices may be used to delineate topics and can be labeled using letters or numbers. Each appendix should start on a new page. Reference each appendix and the information it contains in the main text of the report where appropriate.

Note: Delete this page if no additional appendices are included.

References

Provide a numbered list of all references in order of appearance using APA citation format. The reference page should begin on a new page as shown here.

[1] VCU Writing Center. (2021, September 8). *APA Citation: A guide to formatting in APA style.* Retrieved September 2, 2024. https://writing.vcu.edu/student-resources/apa-citations/

[2] Teach Engineering. *Engineering Design Process*. TeachEngineering.org. Retreived September 2, 2024. https://www.teachengineering.org/populartopics/designprocess

[3] IBM Watson's AI in IT Service Management:
Source: IBM. (n.d.). *IBM Watson for IT operations*. IBM. Retrieved October 10, 2024. https://www.ibm.com/cloud/watson-aiops

[4] ServiceNow Virtual Agent:
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[5] IPsoft's Amelia for ITSM:
Source: IPsoft. (2020). *Amelia for IT Service Desk*. IPsoft. Retrieved October 10, 2024.https://amelia.com/it-service-desk/

[6] AI in IT Service Management:
Source: Gartner. (2019). *Hype cycle for IT service management*. Gartner. Retrieved October 10, 2024.https://www.gartner.com/en/documents/3880910