**Exploring the Potential of AI Chatbots in Electrical Construction: Addressing Challenges and Leveraging Opportunities for Enhanced Productivity and Collaboration**

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**Project Summary**

Background. Understanding the potential uses of AI in electrical construction is both challenging and important research. Artificial Intelligence is growing in many industries, but the potential uses of this technology in electrical construction is largely unstudied. An AI chatbot is a software that is designed to talk to humans by using artificial intelligence. The motivation for this study is to find common problems in the electrical construction industry and to utilize AI chatbots to help solve these problems. AI chatbots can potentially increase safety, efficiency, and communication in the industry.

Objectives. This study has three main objectives that are: (1) to develop an AI chatbot tailored to specific needs of the electrical construction industry, (2) to create user-friendly training videos, and (3) an outreach component that teaches electrical companies how to utilize the technology. These objectives will help to answer the research question. The study will work to answer the question: “What are the challenges and opportunities of applying AI chatbots in electrical construction?”.

Methods. To study the challenges and opportunities of applying AI chatbots in electrical construction, this study will begin by conducting interviews with 20 industry professionals to identify common problems in the field. Using Chatling, a no-code tool for creating chatbots, a prototype chatbot will be developed to address the industry’s most common challenge that will be identified through professional interviews. The prototype will then be tested and refined with input from both the interviewed contractors and Electri’s team of electrical construction researchers. Once the chatbot is optimized, instructional videos on how to use the chatbots and tutorials on how to create chatbots will be developed using Screencastify, a Google extension. These videos will be shared with the interviewed companies and made accessible via YouTube to allow others in the field to utilize the information. The final stage of the study will involve hosting live seminars with a university professor as well where electrical companies can learn how to develop custom chatbots in real time to address their specific challenges.

Expected Results. The anticipated outcome of this research includes the successful development of an AI chatbot that addresses a specific problem within the electrical construction industry. Furthermore, the training materials and seminars will empower professionals to adopt and implement chatbot technology, ultimately allowing them to allocate their time more efficiently.

Impacts. This research has the potential to drive meaningful changes within the electrical construction industry. By introducing AI-driven solutions, it can enhance safety, boost operational efficiency, and improve communication. This not only addresses current challenges but also has the potential to lead to more innovative ideas for the industry in the future.

**Project Description:**

AI is advancing rapidly in both relevance and accuracy, finding applications across various industries and expanding swiftly into new ones. One such industry experiencing the impact of AI is construction. Within construction management alone, researchers have identified eight key areas where AI can be transformative: cost management, time management, quality management, contract management, dispute management, risk management, safety management, and sustainability (Aladag et al., 2024). This development holds particular significance for the electrical construction industry, which also involves comprehensive management tasks and could benefit from AI integration in these areas. Beyond management tasks, AI technologies such as machine learning, computer vision, natural language processing, knowledge-based systems, optimization, robotics, and automated planning and scheduling are already being used in the construction industry (Abioye et al., 2021). These are equally important to the electrical construction industry because they share similar needs. As AI continues to push the boundaries of what is possible, AI chatbots are being trained to be more human-like and purpose-specific, a development that could significantly impact electrical construction(Su et al., 2021). An AI chatbot is a software that is designed to talk to humans by using artificial intelligence. By training chatbots for industry-specific purposes, they could be used to enhance communication, provide support for technical tasks, and streamline processes. A process that could be streamlined utilizing AI chatbots is design. AI can assist in generating images and facilitating design processes (Abrusci et al., 2023). For electrical construction, this could mean developing chatbots capable of designing lighting layouts or optimizing receptacle placements, creating efficiencies in project planning and execution. Chatbots can support technical tasks and enhance communication by being customized to perform specific business functions, demonstrating their potential to help electrical construction professionals effectively manage budgets, schedules, and resource allocation (Ilieva et al., 2020). This is particularly relevant for electrical construction companies, as it supports the decision-making processes essential for effective business intelligence. As the electrical construction industry undergoes rapid technological growth, it continues to face substantial challenges, making AI’s potential applications both timely and essential.

The challenges faced by the electrical construction industry—spanning communication inefficiencies, safety concerns, and project management hurdles—highlight the transformative potential of AI applications, including chatbots, to address these critical areas and drive innovation. These issues have also highlighted the growing need for data centers (Hammam et al., 2023). Data centers are facilities that house numerous servers designed to store and manage the vast amounts of data required for AI operations. By leveraging data centers, the electrical construction industry can enhance its growth trajectory especially in areas of communication, safety, and management. Communication barriers remain a significant challenge in the electrical construction industry, often causing project delays and escalating costs. Effective communication is essential for coordinating teams, subcontractors, and management to ensure timely project completion and adherence to budgets (Saputri & Nasrulloh, 2024). AI technologies, particularly chatbots, can bridge these communication gaps by facilitating real-time information exchange, automating routine tasks, and streamlining updates on project progress. By ensuring clear and consistent communication, these tools enable teams to collaborate more effectively and reduce costly misunderstandings. Similarly, safety concerns persist as supervisors struggle to monitor compliance across job sites. AI-powered detection tools, such as systems designed to ensure the use of personal protective equipment like hard hats, offer a practical solution for providing alerts in real-time and improving oversight (Li et al., 2023). These innovations improve worker safety and reduce the likelihood of accidents, helping keep the project on track and avoid additional costs. Project management inefficiencies, particularly in budgeting and scheduling, also pose significant obstacles to success (Kim et al., 2022). Complex projects, such as underground electrical systems, often suffer from poor front-end planning, resulting in field change orders, delays, and budget overruns (Nguyen et al., 2024). AI-driven planning tools, equipped with predictive analytics, can address these problems by identifying potential risks early, optimizing resource allocation, and ensuring that all critical aspects of a project are accounted for before the project begins. Additionally, AI-enabled monitoring systems can mitigate the problem of machinery theft or damage on unattended job sites by providing alerts to supervisors about unauthorized access (Zhang et al., 2023). These applications demonstrate how AI can transform project management of electrical construction, creating more efficient and secure work environments. By addressing key challenges in communication, safety, and project management, AI technologies, including chatbots, have already begun re-shaping the electrical construction industry, demonstrating their enormous potential. There are few studies that specifically focus on leveraging AI chatbot technologies to address the unique challenges faced by the electrical construction industry effectively.

Given these identified challenges and needs in the electrical industry, this study addresses the following research question: “What are the challenges and opportunities of applying AI chatbots in electrical construction?” This research focuses on evaluating the current level of AI knowledge within electrical companies, identifying areas where AI assistance could provide the most value, and exploring effective strategies for integrating AI chatbots into existing business operations to ensure seamless adoption of the technologies. This project is significant due to the rapid growth of AI and its potential to positively transform the electrical construction industry. By identifying how AI can effectively be used, the study aims to offer benefits such as streamlining operations, improving communication, decision-making, and training chatbots to meet the electrical construction needs. Additionally, this research seeks to reduce hazards in electrical work, identify and resolve problems, minimize errors to improve quality, and provide electrical company professionals with a tool created just for them.

**Methods**

To answer this research question, a study needs to be completed that will take up to May of 2025. In September, the interview questions were developed and turned into the Instructional Review Board (IRB) for approval. The IRB at FGCU makes sure the research is ethical and that the rights of the participants are protected(Myers, 2021). Currently, I am conducting interviews for the project with a goal of having them all done by the end of December. A sample AI chatbot that addresses one of the problems in the electrical construction industry will be created utilizing help from software engineers, who are professors at the college, based on the interviews in December. The AI chatbot will be tested to ensure that it accurately addresses the problem by March. In April, we will analyze the AI chatbot results utilizing ELECTRI international’s task force and see what other chatbots could be created in the future for the industry. ELECTRI international is a research company that works only with electrical construction research, and they use their experts to help with the research (Electri International, 2024). We will also refine the chatbot and produce videos to help teach the electrical companies how to implement them. There will also be an outreach component that will be to host a seminar to teach people in the electrical construction industry how to use the sample chatbot and how to create their own for their companies. Ethical considerations are taken care of by getting permission for the interviews to be recorded and by getting the questions approved by the IRB. The interviews will also only be analyzed to look at the problems facing the electrical construction industry and all sensitive information will remain confidential. More information about this can be found in Appendix 2. This research will be structured around three key objectives.

**Objective 1: Develop the AI chatbot sample**

The first step was to create interview questions to use to gain knowledge from electrical contractors. These were developed into three categories which are background questions, current challenges and processes, and AI awareness and potential applications. (The full list of questions will be in the appendix). These questions were developed to help me understand the current challenges that electrical contractors are experiencing and how AI could be utilized to help contractors with these problems. These questions were submitted to the IRB and were approved to be used.

The second step was to figure out how to get a diverse set of answers to the questions. We decided to diversify the study by interviewing different types of people in the electrical construction industry. We have and will continue to reach out to field operators, project managers, people in the technical and design departments, business operators, executives and strategic operators, and support personnel. This will give us a diverse set of areas we can look at to develop the AI chatbot to be the most useful. The goal is to conduct 20 interviews to gain an understanding of the challenges that the industry faces. 20 was determined to be a good number of interviews based on Dr. Chau’s expertise in research. Currently, five interviews have been conducted and after the first two interviews were conducted the questions were modified with notes to guide the interviewer based on the answers to the previous questions. These preliminary interviews will pave the way for more in-depth future interviews by refining the questions to enable a more focused and targeted approach.

A potential challenge that may arise is that people may not agree to be interviewed because they do not feel comfortable with it, or they do not have enough time. A way that I will mitigate this problem is by utilizing my social media contacts of people who work in the industry, utilizing contacts that my dad has from working in the construction industry, and utilizing contacts that professors have at Florida Gulf Coast University. This will give me a large number of diverse individuals to interview and gain different perspectives from. The interviews are being recorded utilizing a plaud AI recording device that also transcribes everything that is said in the interviews, and for this a backup recorder will also be used and manually transcribed for accuracy. Another tool that is being used is Microsoft Teams and this also records and transcribes the interviews. A simple recorder, such as a digital recorder, is also being used in the interviews to make sure there is a backup to the AI translations of the interviews.

The third step is to analyze the interviews utilizing three types of analysis which are thematic analysis, content analysis, and sentiment analysis. Thematic analysis is a qualitative analysis method that will be used to identify, analyze, and interpret patterns in the interviews to create themes (Braun & Clarke, 2021). Content analysis will be used to interpret the meaning of the themes that we created based on the interviews (Kuckartz & Rädiker, 2023). Sentiment analysis will then be used to analyze if the interviewees had a positive or negative reaction to the themes that were found in the interviews (Liu, 2020). This will allow us to analyze if the themes are accurate. Utilizing these analysis techniques will allow us to determine the most common problem that was found and will allow us to know what to focus on when developing the AI chatbot.

The fourth step involves developing a sample AI chatbot using an AI-powered platform that does not require coding knowledge. One example of such a platform is Chatling, although it is uncertain if this will be the specific tool used in this study. I will develop this with the help of software engineering professors and with the help of my mentor professor Dr. Chau who has a lot of experience with AI. This will be developed at Florida Gulf Coast University, and I will have students test this chatbot out first to receive their feedback.

The fifth step is to utilize the resources of ELECTRICI International’s taskforce. This organization only works with electrical construction and Dr. Chau has submitted a proposal to them to help us with this research and provide expert feedback. They will analyze the chatbot for any errors or room for improvement. I will take the feedback from their organization and will make the necessary adjustments to the chatbot to make it effective.

The sixth step is to have the people that I conduct interviews with test the chatbots and provide me with feedback on how user friendly they are and if they think that the chatbot is effective. I will utilize their feedback to make final adjustments and to find out more information that I will have to add to the training videos.

One problem that may occur is that the chatbot may not be effective even after the revisions are done. I plan to mitigate this by continuing to learn as much as I can about AI and by using experts in the field to help me understand the needs of the industry and of AI.

**Objective 2: Create Training Videos**

There will be multiple videos created. These videos will be made using a program such as Screencastify. This program allows you to record the videos and edit them to upload on YouTube, which is where the videos will be found. The first video will detail how to use the chatbot. This will be a walkthrough video with steps to follow for electrical contractors. The second video will be a guide on how the chatbot was created. It will teach the electrical contractors how to create their own chatbot in a step-by-step example. These videos will be edited to keep them concise and user-friendly. The number of videos to be created will depend on the feedback received about the AI chatbot sample.

**Objective 3: Outreach**

The last objective is outreach. We will develop a half-day workshop that will be used to teach electrical contractors how to create their own chatbots in real time. This will be conducted by Dr. Chau, professor at Florida Gulf Coast University, and myself. This workshop will be a workshop that will help electrical contractors create chatbots that focus on their individual needs and solve problems that they need solved. This will help electrical contractors be more efficient in their daily lives. The exact location of the workshops will be determined later. The complete schedule can be found in figure A.

**Expected Results:**

Deliverables. **Survey Results:** This will be displayed in a chart. **Sample Chatbot:** A chatbot will be created that will help solve one major problem in electrical construction. This will be provided through email to the contractors that were interviewed at the beginning of the project. **Report:** A report will be created that outlines the work and findings of the research. **Tutorial Videos:** Videos will be created that teach viewers how to use the chatbot and how to develop their own. These videos will be uploaded to YouTube. **Seminar Materials:** Materials needed to host a seminar/workshop will be created and utilized by Dr. Chau and I to facilitate the training of electrical contractors in the area.

Outputs. **Research Findings:** An analysis of common problems in the electrical construction industry will be created based on interviews and by conducting thematic, content, and sentiment analyses. A research paper will also be written detailing how the chatbot was created and how the feedback helped to modify it to become a successful product.

Outcomes. **Enhanced Understanding:** A deeper understanding of how AI can be utilized in the electrical construction industry to increase efficiency in operations. Also, electrical contractors will be able to access tutorial videos and attend workshops to help them increase their knowledge of artificial intelligence and be able to begin utilizing these tools.

Impacts. **Future of Electrical Construction:** This project will help shape the growth that the electrical construction industry can make. It will help the industry to get rid of any time that is wasted such as tasks that have to be done over and over. This research will also help educate electrical contractors in the field to improve their knowledge of AI and help them become more innovative.

**Schedule:**



**Figure A: Research Activities Schedule: AI in Electrical Construction**

**Contingency Plan:**

1. **Conducting Interviews**

**Risk:** This may take longer than expected to get the interviews done.

**Contingency Plan:** If it takes longer than expected, then I will focus on the interviews already conducted at that point for the analysis and finish the other interviews later.

1. **Creating the Chatbot**

**Risk:** This may be harder than I originally anticipated to do on my own.

**Contingency Plan:** If this becomes too hard, I will ask a professor at FGCU in the software engineering department to help me on it more.

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**Appendix 1 Research Interview Questions**

Background questions:

1. Could you briefly describe your role in the electrical construction industry?
2. How long have you been working in the field?
3. What are the main types of projects you typically work on?

Current Challenges

1. Could you walk me through a typical day in your role, focusing on tasks that involve accessing information, decision making, or following specific processes?
2. What are the most challenging or time-consuming aspects of your daily work, and how do you handle them? (Follow-up: How do you think a chatbot assistant might help with these challenges?)
3. Are there any repetitive tasks in your work that you find particularly tedious? Can you describe one in detail? (Follow-up: How much time do you estimate that you spend on this task?)
4. In your area of work, what are some common issues or mistakes that people often encounter? How are these typically addressed? Is there any possibility that they cannot be discovered and resolved in a timely manner?
5. How do you currently handle tasks that require looking up information from company documents, industry standards, or databases? (Follow-up: What challenges do you face in this process?)
6. Can you describe any routine analysis or decision-making processes you perform regularly in your work? (Follow-up: How do you ensure accuracy or consistency in these processes?)
7. How do you stay updated with changes in industry practices, regulations, or company policies? What challenges does this present?
8. Can you think of any aspects of your work where even small improvements in efficiency or accuracy could lead to time or cost savings?

AI Awareness and Potential Applications

1. Are you familiar with AI or chatbot technologies? If so, how have you encountered them in your work or personal life?
2. Have you or your company used any AI tools in your work? If yes, could you describe that experience?
3. In what areas of your work do you think AI could be the most helpful?
4. What concerns, if any, do you have about using AI in your industry?

Closing Thoughts:

1. Based on our discussion, how do you envision AI chatbots potentially changing your work in the future?
2. Do you have any other thoughts or suggestions about integrating AI into the electrical construction industry.

**Appendix 2 Data Management Plan**

**Types of Data and Data Collection:**

**Qualitative data** from interviews, including audio recordings and transcriptions. **Feedback data** from testing the chatbot, including emails and user verbal feedback. **Video Recordings** from some of the interviews and the videos created for the tutorials.

**Data Collection:**

**Interviews** will be conducted using a Plaud AI recording and transcribing device, Microsoft Teams, and by a backup digital recorder that must be manually transcribed. **Feeback** will be collected through emails and recorded phone calls. **Videos** will be created using Screencastify and will be uploaded to YouTube for more viewership. A report will be written to explain the data from the research.

**Data and Metadata Standards:**Data Format: Interview transcripts will be in (csv.) format. Interview recordings will be in (mp3 or mp4) formats. Videos will be on YouTube with their own (URL).

**Dissemination, Access and Sharing of Data:**

Data storage and sharing: The chatbot will be readily available online once the contractors who were interviewed get access to it. The videos will be accessible via YouTube and will be free to watch, so that more contractors will have access to it. The workshops will be available locally and the materials will only be provided to those who attend. Interviews and will only be accessible by the primary researcher and any research assistants, but names and company names will be blacked out be for any analysis is completed. All data will be stored in google drive and one drive and sensitive data will be stored on a computer that has a password to protect it.

**Re-Use, Re-Distribution and Production of Derivatives**

Ethics, Privacy, and Security: There are ethical considerations, and the privacy and security of these individuals will be protected using password protected computers and their names will be blacked out along with their company names. This will protect the identities of the professionals who were interviewed.

**Archiving of Data:**

Data will be stored on Youtube for the videos, and these will remain publicly available. Data will also be stored long-term on google drive and one drive. The report will be made available as a pre-print with a (doi) on a platform that will be determined later.