Request for Research Funding for FY 2024-2025			
Project Number (Research Center Use Only): D5-25-05			
Requesting Office	D5 Modal Development Office	**Priority**	5 of 5 (projects may not have the same ranking – no ties)
Proposed Title	AI Workbot: Navigating Work Program Instructions with Artificial Intelligence		
Justification	The Florida Department of Transportation (FDOT) Work Program Instruction Manual offers comprehensive guidance on work programs, programming guidelines, federal aid programs administered by the Federal Highway Administration, and production management tailored to the state of Florida. The manual contains highly detailed and technical information, which is complex and lengthy. As a result, only a limited number of FDOT employees are knowledgeable about its contents. Consequently, users from different FDOT offices often spend significant time reviewing the instructions to find solutions for specific queries. In some cases, users may need to directly contact the employees responsible for drafting and maintaining the manual to obtain the necessary information. This makes it time-consuming to obtain specific information from the Work Program Instruction manual, with considerable time spent reading, understanding, and on the phone seeking answers. The advent of ChatGPT offers a promising direction for the development of a similar platform capable of parsing the Work Program Instruction manual and providing accurate answers. Leveraging the ChatGPT platform, various AI tools have emerged with a focus on reading and comprehending PDFs to answer questions. Examples include PDFgear, ChatPDF, PDF.ai, QuillBot, Jasper, ChatGPT 4.0, DALL-E, and more. While these AI tools effectively summarize the content of PDF documents and address general queries, multiple rounds of preliminary content reading and search tests suggest that PDFgear and ChatPDF excel in providing more accurate and detailed answers in contrast to other AI tools. However, their performance may be limited when confronted with highly specialized and specific logic user queries, particularly those related to interpreting figures, and tables, and with transportation technical expertise. This limitation primarily stems from a lack of systematic training and advanced search algorithms tailored to the nuances of distinct yet closely related PDF documents, such as the FDOT Work Program Instruction manual. Therefore, the goal of this research is to develop a specialized AI Workbot customized for FDOT Work Program Instruction Manual. Diverging from current AI tools that primarily handle general inquiries regarding PDF contents, this Bot strives to stand out by providing comprehensive and logical responses for both general and highly specialized queries. The objectives of the project encompass: (1) To train a specialized AI Workbot for FDOT Work Program Instruction manual: • Incorporate domain knowledge from FDOT Work Program Instruction manual into training the AI Workbot. (2) To develop an AI Workbot for FDOT that can: • Read and interpret PDF documents with texts, figures, and tables. • Answer both general and specialized queries. (3) To provide golden standards/principles to evaluate and optimize the performance and accuracy of the AI Workbot: • Work with the FDOT Work Program Office to develop standard answers for sample inquiries and evaluate the accuracy of query results. FDOT Compass: Technology & Workforce Development. Technology: The research will aid FDOT in the potential adoption and adaptation of artificial intelligence tools for staff use. Workforce Development: An AI work program instructions “expert” will empower FDOT employees at all levels and disciplines.		
Impact	This interactive AI Workbot can streamline the process for FDOT central offices and districts, helping them familiarize themselves with the contents of the FDOT Work Program Instruction Manual. It enables swift and accurate responses to queries, both general and highly specific, related to the content within the Work Program Instruction Manual. Consequently, the AI-based Bot holds the potential to significantly save time and enhance efficiency for users compared to traditional manual methods of inquiry and search.		
Affected Offices	FDOT Central Office and Districts personnel or users who refer to the FDOT Work Program Instruction Manual for both general and specific queries.		

<table>
<tr><td>Existing Work</td><td colspan="3">To date, we have not yet identified any relevant research project in the Transportation Research Board (TRB) project inventory. However, several related research works have been conducted and published in other fields, for instance:

(1) Medeiros et al. (2023): Analysis of Language-Model-Powered Chatbots for Query Resolution in PDF-Based Automotive Manuals offers insights into the effectiveness and applicability of chatbots within the automotive industry, specifically in the context of interacting with automotive manuals, to facilitate the implementation of productive generative AI strategies that align with the sector’s requirements in addressing queries based on PDF files.

(2) Tiwari et al. (2023): AI Chatbot for College Enquiry integrates AI techniques and natural language processing to create an AI-based chatbot capable of understanding and resolving any college-related query, aiming to reduce the time and efforts of humans by identifying the input, context, and intent and reacting accordingly, ultimately delivering optimized results.

(3) Yang et al. (2022): A Large Language Model for Electronic Health Records develops a large clinical language model named GatorTron using >90 billion words of text. The GatorTron model demonstrates superior performance on five clinical natural language processing tasks including clinical concept extraction, medical relation extraction, semantic textual similarity, natural language inference, and medical question answering. As a result, the GatorTron model has been integrated into medical AI systems to improve healthcare delivery.

However, existing research lacks the development of a dedicated AI-based Chatbot tool specifically designed for FDOT Work Program Instruction Manuals. Current AI chatbot tools are not readily adaptable for direct implementation in addressing queries related to FDOT Work Program Manual.</td></tr>
<tr><td>Keywords Used In Existing Work Search

(Cannot leave blank)</td><td colspan="3">FDOT Work Program Instruction Manual, AI-empowered Chatbot, PDFs, Generative AI, Highly Specialized Query, Large Language Models</td></tr>
<tr><td>Related Contracts (Give contract numbers)</td><td colspan="3">Not available</td></tr>
<tr><td>Funding Request</td><td>$ 388,000 (with two PIs, one with expertise in Large Language Models and Natural Language Processing (NLP), the other with expertise in AI in transportation, using AI computing power at UF)</td><td>Anticipated Duration</td><td>18 months</td></tr>
<tr><td>Project Manager</td><td>Paul Schoelzel</td><td>Contracting Method</td><td>Direct contract with University of Florida</td></tr>
<tr><td>Equipment</td><td>N/A</td><td colspan="2">No equipment will be purchased for this project. The UF team will however utilize UF’s supercomputer for DI development/training, which does come with the associated “computing expenses.”</td></tr>
<tr><td>Urgency</td><td>1</td><td colspan="2">Comments: FDOT has invested millions of dollars in developing, updating, and disseminating the Work Program Manual. However, utilizing these manuals requires specialized knowledge, and users often find themselves investing significant time in searching for answers to specific queries. This process can be further complicated by limited staff at the Work Program office, leading users to face challenges in obtaining essential information in a timely manner. Consequently, the FDOT Work Program Instructions Manual are perceived as less user-friendly, with considerable time spent seeking answers from their contents.

In response to these challenges, there is an opportunity to develop a specialized AI Workbot tool that aims to save time and enhance the usability of the FDOT Work Program Manual for FDOT staff, and potentially non-FDOT partners at all levels. Furthermore, the</td></tr>
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		AI-powered Bot can be expanded to include other FDOT programs in the future, thereby increasing the overall efficiency of the FDOT workforce.
Implementability	1	Comments: The results of this project would be directly applicable to FDOT Central and District offices, as well as other personnel and partner agencies who need to access and utilize the FDOT Work Program Instruction Manuals.

Project Benefits (Succinct, complete explanation)

1. Time Savings: The AI WorkBOT developed through this research will serve as an interactive query-answering tool for users of the FDOT Work Program Manual, saving valuable time for both direct users and Work Program Office staff.
2. Enhanced Efficiency and Usage: The AI WorkBOT will improve comprehension of the Work Program Manual's contents, fostering increased work efficiency and encouraging greater utilization of the manual.
3. Leadership in AI-powered Transportation Automation: This project will position FDOT as a national leader in developing an AI WorkBOT, showcasing FDOT's commitment to technological innovation and elevating its visibility in the field.
4. Facilitating a better understanding of the work program instructions may enable users to leverage synergies among various projects, funding sources and work mixes/disciplines. This could lead to increased project efficiencies and potentially reduced costs, saving taxpayer funds.

Project Benefits **(Select all that apply and explain)**	**Quantifiable Benefits (units, dollars, etc…if applicable)**	**Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits**
o Materials Enhancement		
o Financial Impact		
o Time Savings	The AI-based chatbot has the potential to substantially reduce time spent and boost efficiency for users seeking answers within the FDOT Work Program manual.	Having access to a subject expert 'AI Workbot' for work program instructions would not only relieve work program staff from impromptu question and answer sessions with FDOT partners/peers but also empower all FDOT employees across various disciplines. This access enables them to understand the available resources, their proper utilization, and potentially gain valuable insights into efficiencies that work program staff might not necessarily be privy to, such as design, maintenance, or operations experience.
o Lives Saved/Injuries Prevented		
o Other (Explain)	Lead technology innovation	The AI WorkBOT developed by this research would be the first in the nation, and would pave the way for future innovations involving additional FDOT guidance/manuals Lessons learned from this research may inform FDOT leadership/CO/Research on the viability and utility of AI based tools.

*Comments should explain and support urgency, financial benefit, and implementability scores