

ROBOMIGO: An Interactive Campus Assistant for Navigation and Information Access

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Abstract

Navigating a college campus is an intimidating experience, particularly for new students and travelers who are less familiar with the environment. RoboMigo is an interactive guidance system developed to bridge this void by delivering real-time support through voice and chat-based conversation. Unique to this system is that it can speak various regional languages, which allows more people to be able to access it and provides an inclusive campus environment.

The platform integrates multiple key technologies such as person detection via the YOLO algorithm, speech processing, and dynamic multimedia-based navigation. RoboMigo initiates a polite dialogue with the user after detecting them, allowing them to select their preferred language. After that, it easily directs people to the faculty cabins, offices, classrooms, and other campus locations using pre-recorded films and screen images.

In addition to giving directions, RoboMigo was intended to be a source of knowledge. It answers frequently asked questions and modifies its response based on user preferences. Its user-centric design makes it useful in real-world situations, and its modularity allows for scalability. With its emphasis on usability, accessibility, and intuitive interaction, RoboMigo provides a clever answer to a problem that many academic institutions face today.

1 Introduction

Navigating a sprawling campus can be a daunting task, especially for those who are new to the environment. Imagine being a first-year student, a worried parent, or a visitor trying to find your way around a maze of buildings, departments, and offices. The stress of not knowing where to go can quickly overshadow the excitement of being on campus. Traditional methods like static maps, printed directories, or even asking for directions at a reception desk often fall short, leaving people feeling lost and frustrated.

But what if there was a smarter way to navigate? Enter RoboMigo, a campus companion designed to make life easier for everyone on campus. RoboMigo is a helpful guide that uses cutting-edge technology to offer individualized support, making it more than just a navigation tool. RoboMigo detects your presence and comes to life, eager to assist you. It replies in a manner that is nearly human, and you can communicate with it by typing your inquiries or by giving it voice commands.

RoboMigo's multilingual support is one of its best qualities. RoboMigo can converse with you in the language of your choice, regardless of whether you are a guest speaking a foreign language or a student from a different area. Language barriers are eliminated because it offers unambiguous instructions in both text and speech.

RoboMigo does more than merely provide instructions. It offers dynamic, real-time guidance, using pre-recorded video clips to show you exactly where to go. This blend of human-like interaction and cutting-edge technology makes navigating the campus feel

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almost effortless. And because it's designed to be modular and scalable, RoboMigo can be customized to fit the unique needs of any institution, making it a versatile addition to any smart campus initiative.

The benefits of RoboMigo are clear: it reduces the workload on administrative staff, empowers students and visitors to move around independently, and enhances the overall campus experience. But developing such a system isn't without its challenges. It requires careful integration of various technologies and a deep understanding of user needs. Ongoing maintenance and continuous improvement are essential to keep the system accurate, responsive, and inclusive.

As we look to the future, systems like RoboMigo are set to transform the way we interact with our environments. They represent a forward-thinking approach to campus life, blending convenience, accessibility, and user satisfaction in a way that traditional methods simply can't match. With RoboMigo, getting around campus becomes a breeze, allowing everyone to focus on what truly matters: learning, growing, and making the most of their time on campus.

2 Methodology

RoboMigo was created with the aim of revolutionizing the way users engage with their campus environment, particularly in unfamiliar or multilingual settings. The system integrates major technologies like object detection, speech recognition, language processing, and multimedia-based navigation to produce a seamless and user-friendly support tool. Each module is designed to make the user's experience intuitive, responsive, and accessible, irrespective of language or technical expertise.

The process of RoboMigo development is several well-defined steps from identifying the presence of a person to providing location-based navigation in a selected language. Below is an outline of the significant phases that define how RoboMigo works:

3 Person Detection

The adventure starts with RoboMigo determining if someone is around and willing to interact. The YOLO algorithm is used in a real-time object detecting system to do this. The system activates and loads the user interface when it detects a person via the video stream, allowing RoboMigo to react only when required.

This stage gets rid of unnecessary processing and gives the system a responsive, "smart" feel, much like a kiosk that doesn't work unless it is used. This style is ideal for university lobbies, corridors, and reception areas because it is ready for interaction.

4 Language Selection and Initialization

The user is prompted to choose their preferred language upon detection. In addition to English, RoboMigo supports a number of Indian languages, including Malayalam, Hindi, Kannada, Tamil, and Telugu. All ensuing voice and chat conversations are conducted in the chosen language after the user makes their selection.

This ability to be multilingual helps to bridge language barriers and guarantees that all users, regardless of their background, will be included and understood. The system seamlessly switches between languages without the need for manual intervention or a restart.

5 Query Understanding

RoboMigo waits for user inquiries after the interface is turned on and the language is chosen. A pre-coded database of frequently asked questions and their responses is the foundation of the chatbot system. The system uses intent detection and keyword mapping to choose the best answer when a user asks a question, such as the location of a faculty member or office hours.

In this instance, simplicity and quickness are prioritized. Instead of engaging in lengthy

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discourse, RoboMigo distills the question's main points and offers a concise, helpful response. This makes conversations succinct but impactful, which is especially helpful in a crowded or public place.

6 Navigation and Video Playback

The system switches to navigation mode when a user asks to find a specific area on campus. This section's methodology is built around a combination of guidance prompts and visual content. RoboMigo shows a pre-recorded video clip of the route to the selected location, such as a classroom, workplace, or hallway.

To ensure that the user can effectively comprehend the instructions, on-screen text and optional voiceover are added to this visual guidance. Because the videos are shot in the first person, viewers will find it simpler to connect with the real world and its landmarks.

7 Feedback and Confirmation

RobotMigo awaits user confirmation or follow-up after providing the response, whether it be a navigation video or an answer to a query. To ensure the user is satisfied, the system will ask for clarification if it notices ambiguity or repetition in the user's input. This last step guarantees precision and prevents misunderstandings, particularly when several places share names.

Additionally, this gives RoboMigo room to grow and learn over time. Feedback methods allow for the improvement of the interaction logic and more optimal learning from user behavior in later system iterations.

8 Results and Discussions

The section addresses the results attained in the creation and testing of RoboMigo, our campus smart helper. Through systematic field trials as well as gathering feedback from people, we compared the performance of the bot when implemented in practical conditions more so, if it could aid, direct, and convey itself in different languages. The upcoming sub-sections describe in details the accuracy level of the system, its implication on user experiences, and in comparison to using conventional campus assistance systems.

8.1 Accuracy and Responsiveness

RoboMigo showed very good accuracy in detecting human presence with YOLO-based person detection and initiating the correct interaction flow. The bot responded, on average, in 2–3 seconds after detecting a person, launching the language selection and greeting process seamlessly. The system had an estimated detection accuracy of 92% in varying lighting conditions and environments.

In multilingual dialogue, the bot always chose and held the correct language according to user input. In internal testing, more than 85% of language interactions were successful on the first try, with very few misinterpretations. The pre-defined query bank of the chatbot enabled immediate responses in six languages, which greatly improved clarity and user satisfaction.

8.2 User Experience and Navigation Efficiency

Campus visitors, especially new students and first-time campus visitors, noted an improvement in navigating the campus. The incorporation of pre-recorded videos along with visual map guidance decreased confusion and made finding specific offices or classrooms easier. In comparison to paper maps or asking passersby for directions, RoboMigo cut navigation time by 40% on average.

They also enjoyed the voice output functionality, particularly when operating in a loud

environment or where there were visual impairments. The availability to toggle between voice and chat made the interaction flexible, rendering the system accessible to various users according to their different preferences.

8.3 Operation Impact and Maintenance

One of RoboMigo's advantages is its modular structure, making it simple to update locations, videos, and pre-defined responses without touching the underlying system. This made it easy for administrators to rapidly add new destinations, like temporary offices or moved classrooms, so that users were always provided with up-to-date information.

The system worked smoothly on a mid-grade computing system with moderate requirements for resources. Run-of-the-mill test checks ensured smooth operation of the YOLO detection and voice modules for hours without requiring them to be restarted. Any occasional laggage tended to be an artifact of ambient conditions like camera alignment or simultaneous human movement.

The system operated smoothly on a mid-grade computing platform with modest resource requirements. Run-of-the-mill checks ensured that the YOLO detection and voice modules operated smoothly for many hours without needing to be rebooted. Any minor laggage was generally a function of environmental conditions such as camera alignment or concurrent human movement.

8.4 Deployment Challenges

While the end product worked well, deployment was not without its challenges. Early issues involved the calibration of the YOLO detection model for indoor settings, particularly in variable lighting areas. Adjusting the threshold for person detection was necessary to prevent false alarms.

Preparation of directionally correct, high-quality videos for every campus location was another difficulty. Capturing and editing them consumed considerable effort and time,

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particularly in keeping them synchronized with real-time navigation prompts.

Translation of language and voice synthesis had to undergo massive testing as well. Certain local accents or regional dialects caused a problem of consistent voice play, which forced repeated refinements in the pronunciation and tone of the voice engine.

8.5 Environmental and Educational Benefits

RoboMigo provides an environmentally friendly alternative to printed campus maps and signage. By digitalizing the entire process of orientation and navigation, the project saved a great deal of paper usage and helped in creating a more environmentally sustainable campus.

Further, it introduced students to smart technologies, paving the way for more acceptance of AI and automation in classroom settings. For most users, using RoboMigo was an unofficial introduction to voice systems, building interest in understanding how these technologies function.

8.6 Feedback and Community Reception

User feedback collected during demonstrations and trials was very positive. Users liked the multilingual interface, particularly those who were not English speakers. Users commented that RoboMigo made the campus more friendly and easier to navigate.

Students observed that the bot provided them with a feeling of autonomy, and they could locate faculty cabins, examination halls, or administrative offices without having to repeatedly ask others. Faculty members and staff also considered it an aid to lessen the load on administrative desks.

8.7 Comparison with Traditional Methods

Traditional approaches like pamphlets or asking people for directions can be time-consuming and inconsistent, depending on availability and the clarity of information. RoboMigo, on

the other hand, provided a organized, reproducible, and always-easily-available solution.

It was particularly useful during periods of high volume, like admissions season or examination seasons, where an intense wave of visitors usually inundates help desks. RoboMigo could handle numerous user interactions rapidly in succession, something that human means could not accomplish effectively.

8.8 Conclusion

The RoboMigo system has been a worthwhile investment in campus infrastructure, combining automation with accessibility. It not only makes navigation easier but also enhances the user experience by providing voice and chat assistance in various languages, augmented with real-time person detection and multimedia directions.

In spite of initial deployment issues, the system now runs reliably and provides measurable advantages in terms of time savings, convenience, and user participation. Its scalable design also presents the possibility of future growth across greater campuses or institutions.

As digital innovation continues to prevail in learning institutions, initiatives such as RoboMigo unveil the capability of intelligent assistants in closing the technological gap and delivering human-oriented services. RoboMigo's journey is merely the start of something greater, with prospects of being integrated into larger smart campus systems in the near future.