Bases for the creation of a virtual voice assistant for the hotel environment

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Resumen

Introducción: Los asistentes de voz han evolucionado significativamente en un corto período de tiempo. Actualmente es una tecnología muy útil y que brinda una cantidad de facilidades que cada día aumenta, ocasionando que sea aplicada en cualquier tipo de ámbito. Las instalaciones hoteleras son uno de esos espacios en los que son empleados, reportándose numerosos casos éxito. De manera contraria ocurre en Cuba, donde esta tecnología no es comúnmente empleada y que muchas instalaciones no cuentan las condiciones necesarias para la implementación de la misma. **Objetivo:** Proponer las bases para la creación de un asistente de voz virtual para el entorno hotelero. **Metodología:** Se empleó el método deductivo, pues, a partir de un análisis general sobre los concerniente a los asistentes de voz y la automatización de instalaciones, se definieron las cuestiones particulares del asistente propuesto como sus características, así como el hardware y el software con que contará. Es una investigación de tipo aplicada, cualitativa, documental, de campo, longitudinal y explorativa. **Resultados:** El dispositivo se desarrollará con hardware y software libre por las facilidades al momento de trabajar con ellos. Funcionará de manera offline y por comando dado por voz para que pueda ser utilizado en cualquier lugar y por cualquier persona sin impedimentos por dichas cuestiones. Desde el punto de vista estructural, el dispositivo se conectará directamente a la corriente y tendrá como componentes un transistor, una bocina, una fuente, una Raspberry Pi 3, un micrófono y un relé con transistor. Empleará como software la plataforma Home Assistant, debido a las bondades y la utilidad con la que se cuenta al momento de su uso. **Conclusión:** El asistente de voz cumple con un conjunto de requisitos que harán de él un dispositivo útil y flexible para su empleo en cualquier instalación turística. Su estructura cuenta con todos los componentes necesarios para que cumpla con las funciones para las que fue concebido. Contará con un software sencillo para el empleo del usuario y que puede ser modificado de manera sencilla. **Área de estudio general:** Ingeniería Biomédica. **Área de estudio específica:** Electrónica.

Abstract

Introduction: Voice assistants have evolved significantly in a short period of time. Currently it is a very useful technology that provides a number of facilities that increases every day, causing it to be applied in any type of field. Hotel facilities are one of those spaces in which they are used, with numerous success stories reported. The opposite occurs in Cuba, where this technology is not commonly used and many facilities do not have the necessary conditions for its implementation. Objective: Propose the bases for the creation of a virtual voice assistant for the hotel environment. Methodology: The deductive method was used, since, based on a general analysis of those concerning voice assistants and facility automation, the particular issues of the proposed assistant were defined, such as its characteristics, as well as the hardware and software it will have. It is an applied, qualitative, documentary, field, longitudinal and explorative research. Results:The voice assistant will be developed with free hardware and software for the ease of working with them. It will work offline and by voice command so that it can be used anywhere and by anyone without impediments due to these issues. From a structural point of view, the device will be connected directly to the current and will have as components a transistor, a speaker, a power supply, a Raspberry Pi 3, a microphone and a relay with a transistor. It will use the Home Assistant platform as software, due to the benefits and usefulness it has at the time of use. Conclusion: The voice assistant meets a set of requirements that will make it a useful and flexible device for use in any tourist facility. Its structure has all the necessary components to fulfill the functions for which it was designed. It will have simple software for the user to use and that can be easily modified.

Introduction

Alan Turing(Turing, 1950)In his essay "Computing Machinery and Intelligence" he suggests that machines think and ask questions for themselves, being considered the first record and the first person to refer to artificial intelligence (AI).(Vidal, 2007). In fact, he is currently considered the father of AI.

By the end of the last century, AI was at its peak and many researchers based their projects on Turing's theories.(Melendez et al., 2000)One case is the Artificial Neural Network model by Warren McCulloch and Walter Pitts, considered the first work in the field of artificial intelligence, although at that time the concept had not yet emerged as such.

In 1966, J. Weizenbaum developed ELIZA, a program included in the MIT (Massachusetts Institute of Technology) hardware and designed with the purpose of simulating a conversation with a psychotherapist, being able to interact with humans in natural language.(Hernandez, 2007).

In the 1970s, psychiatrist Kenneth Colby developed a program known as PARRY(Martin & Allende, 2015). It was designed to simulate the behavior of a paranoid person, providing defensive and hostile responses during conversations. PARRY was more advanced than ELIZA and incorporated an attitudinal conversational strategy.

In 1972, R. Shank introduced the Conceptual Dependency Theory, a research method for giving machines the ability to understand natural human language. Shank advocated a cognitive approach to the challenge of building intelligent machines.(Barbieri, 2020).

In 1976, the Defense Advanced Research Project Agency (DARPA) initiated a series of Speech Understanding Investigations (SUR)(Liberman & Wayne, 2020)The developers managed to build several speech recognition systems with functions such as voice control of robots, recognition of large vocabularies, speaker-dependent speech recognition, and dictation of almost unlimited vocabularies.

In the early 1990s, IBM developed a supercomputer called Deep Blue, which had the ability to play chess and won a game against the then world champion, Gary Kasparov.(Adaime, 2011; Goorich, 2021). Later, in 1995, Richard Wallace created ALICE, a project aimed at evaluating the implementation of chatbots and which won the Loebner Prize three times for being the technology that presented the most human characteristics.(Goorich, 2021; Teixeira, 2022).

Initially, virtual assistants could be found on web pages.(Martin & Allende, 2015). Nowadays, we can find them directly integrated into our mobile phones, and we can use them on a daily basis. Among the first virtual assistants, the most used were Siri, for the iOS operating system from Apple; Cortana, from Microsoft; and Google Now, from Google. Thanks to the progress achieved in the area of statistical models of machine learning (ML) together with the purpose of training statistical algorithms and the need for a more powerful processing infrastructure, the platforms have been developed to result in intelligent virtual assistants.(Barbieri, 2020)The most widely used ones today are Siri, which has been around for years; Google Assistant, the predecessor of Google Now; and Alexa, which belongs to the Amazon company.

It has been proven that the implementation of artificial intelligence in tourist facilities enhances the quality of customer service(Ureña & Rodríguez, 2023). It was found that the use of technology in customer service provides advantages such as faster responses, fluid communication, instant solutions to common problems, and the acquisition of services and management of reservations is done directly with the hotel. At the Selina hotel in Ecuador, WhatsApp was introduced as an innovative method to serve customers, manage reservations and maintain communication with potential customers. In addition, "Alexa" was selected as a virtual assistant to answer questions and information required by guests, along with the use of QR codes that allow the guest to instantly access services such as automatic connection to Wi-Fi, restaurant menu, access to WhatsApp from reception or restaurant and the WhatsApp group. Additionally, a chatbot was developed that can be accessed through a link in the WhatsApp welcome message. These innovations greatly benefited the hotel, because guests received immediate responses and in some cases without having to go to any area of the hotel to obtain the desired service, since the customer can do so from their room through their mobile device.

At Club Premier, a company in Mexico, a virtual assistant was also created to provide customer service through conversational channels on WhatsApp and the Web, improving customer service and management at the facility.(Ornelas, 2020). Technology from the provider Aivo was used, specifically, the CP-Bot product, which is a virtual assistant with artificial intelligence.

In a hotel located in Guaranda, Ecuador, all HDL buspro devices were identified and connected to the network through the Gateway in an easy way, in addition to the incorporation of Google Assistant and Alexa for more advanced control of the suite.(Rodriguez et al., 2021)This offers a great savings opportunity for the hotel owner, as the sensor will be responsible for turning on the lights based on the light level in the room, as well as turning them off when it detects no presence. The creation of the app provides a great advantage that ranges from activating any device with a single click anywhere in the suite, to controlling it from anywhere outside the city.

In Zaragoza, the Fliggy and FlyZoo hotels have incorporated new technologies that add value to them(Li, 2021)These include service robots, virtual reality (VR) application to view the room, facial recognition, intelligent assistant with voice recognition and self check-in system.

In Santo Domingo, the use of chatbots has been integrated into the hotels' communication channels, allowing for a more personalized and attractive experience for the customer, who, in turn, provides valuable information, which the hotel can use to improve service and boost sales.(Contreras, 2021).

The growing demand for virtual assistants and the benefits that their use has brought in various tourist facilities make it necessary to implement this technology in our country's establishments, since it can have a direct and significant impact on saving resources, an important priority in the face of economic and commercial limitations resulting from the economic blockade and the crisis that the country is going through.

The objective of our work is to propose the bases for the creation of a virtual voice assistant for the hotel environment, focused on the technological characteristics of our country.

Methodology

The scientific method used during the research was deductive, since information about voice assistants, their application in hotel facilities and software used in the field of automation was analyzed, to later define the bases of the desired voice assistant. According to the typology, the research can be characterized as:

- Applied: The practical application of the results seeks to improve the quality of life of hotel visitors by applying advanced and up-to-date technology.
- Qualitative: Previously acquired knowledge of electronics and computing was required to define the specifications that the device should have in terms of hardware and software.
- Documentary and field research: Initially, a search for information was carried out in official databases such as ResearchGate, using the Google search engine as a search engine. Articles in English and Spanish that had been published no more than five years ago, preferably, were selected to analyze the success stories in which a voice assistant had been implemented in a tourist entity. Based on the study of the literature, the characteristics that the assistant had to meet were defined. Then, practical work was required to develop the circuit according to the functionality of each component and to know the configuration of the Home Assistant platform, according to the functionalities that were needed.
- Longitudinal: During the research, three variables were fundamentally studied: requirements that the assistant had to meet in order to be applied in any tourist facility in Cuba, how it should be structured from an electronic point of view and what software the device should have in order to perform the desired functions.
- Exploratory: Virtual voice assistants are widely used internationally, but this is not the case in our country. On the contrary, it is a fairly unknown topic at present and research literature on this subject is very scarce.

Results

General Features of the Assistant

Based on the cases analyzed and taking into account that the voice assistant will be implemented in Cuba, it was determined that it must have the following characteristics:

- Implemented with free hardware and software. These are very useful and cost-effective when carrying out these projects, since they can be easily manipulated and programmed, while not having a high economic cost.
- Having an offline system. It will not require Internet access to operate, as it is important to bear in mind that there are limitations to accessing a good Internet connection, which would mean that in certain places and times the system would be completely unusable.
- It can work using voice commands without having to use the phone for them. In this way, it would be an inclusive assistant that would allow its use by people who may have a disability. In addition, the cell phone's microphone may have limitations in properly capturing the user's voice, especially in noisy and echo-laden environments.

Initially, the device is being developed to be implemented in the rooms of the tourist facility and to act, in principle, on devices that operate with ON/OFF controls. Its structure must essentially include a microphone, so that the user can give instructions to the assistant; a component that processes the orders given and a speaker so that the user receives information, via audio, about what is happening or instructions on what to do.

Hardware

Figure 1 shows the components and structure that the voice assistant should have.

www.concienciadigital.org

Figure 1

Voice assistant structure.
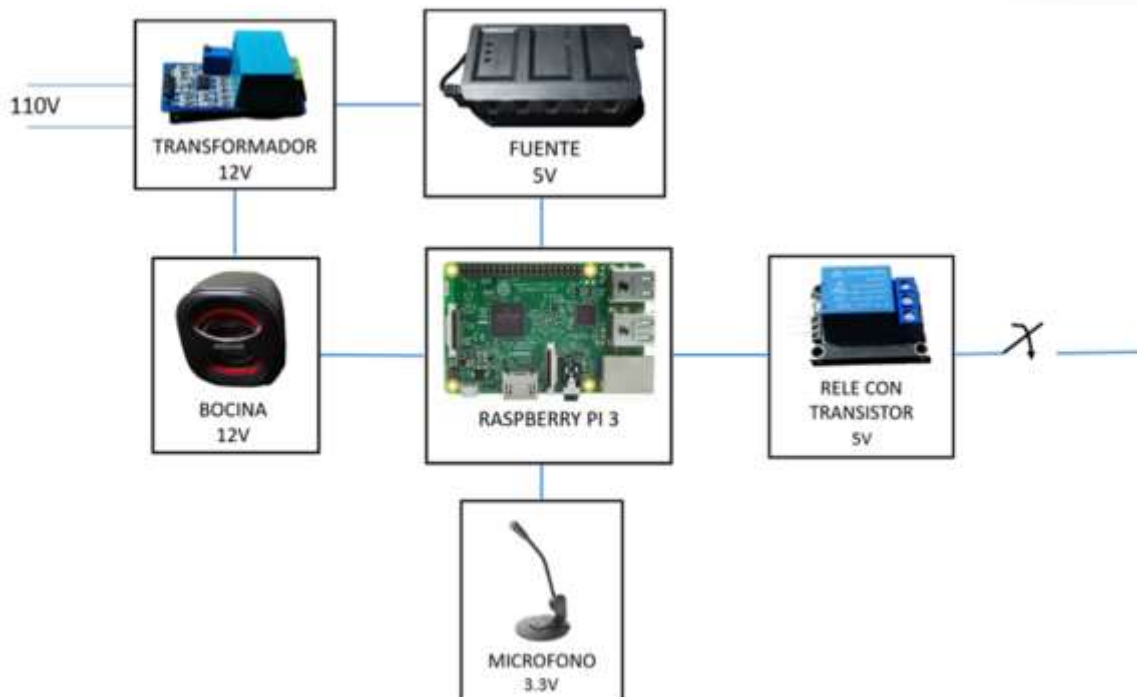
Note: electronic structure of the voice assistant.
Fountain: Own.

The system is designed to be connected directly to the room's electrical grid in a fixed location. It is worth considering that the electrical grid in our country and the world works with alternating current and that the system is designed to work with direct current. The first thing to do is to place a component that transforms the input alternating current into direct current, which is precisely the function of a transformer, which can be seen in Figure 2, which is the first device that appears connected to the electrical grid.

Figure 2

Transformer

Note: First component of the voice assistant.
Fountain: Own.

The transformer, in addition to transforming the current, varies the voltage, since it is supplied with 110V and the output generates 12V. The speakers and the source, shown in figures 3 and 4 respectively, are connected directly to the transformer because they require a 12V supply.

Figure 3

Horn

Note: Second component of the voice assistant.
Fountain: Own.

Figure 4

Current source

Note: Third component of the voice assistant.
Fountain: Own.

The source has the function of generating a voltage of 5V, which is what the Raspberry Pi 3, shown in figure 5, requires to operate.

Figure 5

Raspberry Pi 3

Note: Fourth component of the voice assistant.
Fountain: Own.

The Raspberry is a device very similar to a computer's central processing unit (CPU), with the same functionalities, but smaller in size. This component is where the voice assistant software is programmed, where the orders given by voice are transformed into commands and then those commands execute the actions desired by the client. The speakers, the microphone, which can be seen in figure 6, and the relay with transistor, which can be seen in figure 7, are connected to it.

Figure 6

Microphone

Note: Fifth component of the voice assistant.
Fountain: Carrefour website.

Figure 7

Relay with transistor

Note: Sixth component of the voice assistant.
Fountain: Own.

The relay has the function of being able to turn on or off the equipment in which it is installed, just as it happens when it is done manually to the switch, according to the order given to it. Assuming that a relay is placed in a light switch, if it is given the order to turn on the light, it will close the switch; otherwise, if you want to turn off the light, it will simply open the switch. The intention of the component having a transistor lies in the fact that the relay works with 5V input, so it is necessary, as seen previously, to transform the output voltage of the Raspberry from 3.3V, into the appropriate one for the element to work. In the case of the microphone, it does work directly with the output voltage of the Raspberry. Due to this, both components are connected directly to it.

Software

Home Assistant is a free and open source software focused on home automation with great security(Davidson, 2023). It requires an Internet connection only at the beginning of its configuration, but not during its subsequent use. In addition, the software has all the necessary applications for the constitution of a smart home, allowing its control from a single web interface. Home Assistant is the ideal option for the voice assistant proposal, since it can be used offline, while its features make it a reliable, flexible and safer solution than other current assistants that work online.

Home Assistant will be the software that is installed and configured for the operation of the assistant and whose programming is done on the Raspberry.

The first step is to burn the Home Assistant OS image to the Raspberry Pi microSD card. To do this, download and install the Raspberry Pi Imager software on your computer. Next, plug the microSD card into your computer's card reader, and then use the software to write the Home Assistant OS to the card. Disconnect the card and insert it into the Raspberry Pi, where it can be installed directly from the copied image.

When you start Home Assistant for the first time, you have to configure it online using an Ethernet cable and it may take some time. The next time you run the program, you will not need an Internet connection and it will only take a few minutes to be able to use it. Once the software has started, the first configuration steps are carried out and then you proceed to create the Home Assistant account. Next, the option to configure the devices that were detected will appear, although you will select the option to skip, because in Cuba it is not common to have smart devices that are automatically detected by the software, so you proceed to automate them.

One of the benefits of Home Assistant is that it is an open source platform, which allows the user, using programming languages such as Python, to program the control of the devices they want.

Returning to the case of the switch, the main libraries that will be used will be PyAudio, SpeechRecognition and pyttsx3. PyAudio allows the input or output of audio that will be made through the microphone and the speakers respectively. SpeechRecognition allows the voice commands to be processed and transformed into text. Depending on the orientation, the relay will be activated to turn the light on or off. The information about the correct or incorrect execution of the action is in the form of text (programming code), which is transformed into audio to be output through the speakers, due to the inclusion of the pyttsx3 library that provides this possibility. In this way, the software for the operation of the voice assistant on a light switch is completely configured, which is also applicable to all devices that work with this principle.

Conclusions

- The foundations of the voice assistant for the hotel environment were defined, determining the general characteristics that it must present and comply with, the hardware it must have, as well as the ideal software with which it must work.
- The voice assistant must be implemented with free hardware and software that works without the need for Internet access, and can be executed through voice commands without the need to use a cell phone.

- Initially the system is designed to work on devices that operate only on the on/off principle.
- In the case of hardware, it will structurally consist of a transistor, speakers, a power supply, a Raspberry, a microphone and a relay with a transistor.
- The Home Assistant platform will be used as software due to its flexibility, free nature and the features it offers, which will be installed and configured on the Raspberry.
- The proposal was designed for non-smart devices because they are the most common in Cuba. To do this, use was made of the possibility that Home Assistant offers to control the desired devices through programming in the Python language using the PyAudio, SpeechRecognition and pyttsx3 libraries; which enable audio input and output, audio to text conversion and vice versa.

Conflict of interest

The authors declare that there are no conflicts of interest in relation to the submitted article.

Bibliographic References

Adaime, I. (2011). Kasparov vs. Deep Blue: the conflictive man-machine relationship [Thesis, University of Buenos Aires].https://www.bing.com/search?q=Kasparov+vs.+Deep+Blue%3A+la+conflictiva+relaci%C3%B3n+mano+m%C3%A1quina&qs=n&form=QBRE&sp=-1&lq=0&pq=kasparov+vs.+deep+blue%3A+the+conflictive+relationship%C3%B3n+man+m%C3%A1quina&sc=0-62&sk=&cvid=3B0073847B82419AB7CD2C4E926D4B0D&ghsh=0&ghacc=0&ghpl=

Barbieri, P. (2020). Adoption of intelligent virtual assistants through the commercialization of smart speakers in Argentina [Master's degree, University of San Andrés].https://www.bing.com/ck/a?!&&p=089c596c0291f252JmltdHM9MTcwNTI3NjgwMCZpZ3VpZD0xMzcyMDc0MC1mODVjLTZhOWUtMmU0Mi0xNGJkZjk0MDZiNWQmaW5zaWQ9NTE4NQ&ptn=3&ver=2&hsh=3&fclid=13720740-f85c-6a9e-2e42-14bdf9406b5d&psq=Adoption%C3%B3n+of+intelligent+virtual+assistants+a+through the marketing of smart speakers in Argentina.JTVCUCU1RCU1QlclNUQlMjBNLiUyMEdlcyUyMEJhcmJpZXJpJTJDJTIwUGFibG8lMjBHYXN0JUMzJUIzbi5wZGY&ntb=1

Contreras, L. (2021). Operational impact of the implementation of virtual assistants in the post-Covid-19 hospitality industry in Santo Domingo (Santo Domingo: Universidad Iberoamericana (UNIBE)].https://repositorio.unibe.edu.do/jspui/handle/123456789/812

Davidson, A. (2023). What is Home Assistant, how does it work, and what do you need to get started? Retrieved 06/29 fromhttps://www.pocket-lint.com/what-is-home-assistant-how-does-it-work/

Goorich, J. (2021). How IBM's Deep Blue Beat World Champion Chess Player Garry Kasparov. Retrieved 06/29 fromhttps://spectrum.ieee.org/how-ibms-deep-blue-beat-world-champion-chess-player-garry-kasparov

Hernández, MM (2007). ELIZA: forty years of virtual therapies. Journal of the History of Psychology, 28, 67-76, Article 2.https://www.bing.com/ck/a?!&&p=668834f21a8457cbJmltdHM9MTcwNTI3NjgwMCZpZ3VpZD0xMzcyMDc0MC1mODVjLTZhOWUtMmU0Mi0xNGJkZjk0MDZiNWQmaW5zaWQ9NTE4Nw&ptn=3&ver=2&hsh=3&fclid=13720740-f85c-6a9e-2e42-14bdf9406b5d&psq=ELIZA%3A+forty+a%C3%B1os+of+virtual+therapies&u=a1aHR0cHM6Ly9qb3VybmFscy5jb3BtYWRyaWQub3JnL2hpc3RvcmlhL2FyY2hpdm9zL2ZpY2hlcm9fc2FsWRhMjAyMjA5MjMxMTEyMjU2MjgwMDAAucGRm&ntb=1

Li, Y. (2021). Smart hotels and new technologies applied in the hotel industry. Case study of FlyZoo Hotel [Master's degree, University of Zaragoza].https://zaguan.unizar.es/record/106337?ln=es

Liberman, M.Y., & Wayne, C. (2020). Human Language Technology. AI Mag., 41, 22-35.

Martín, PJ, & Allende, JS (2015). FROM ELIZA TO SIRI: THE EVOLUTION. Tecnologí@ y desarrollo, 13.https://www.researchgate.net/publication/275824572_De_Eliza_a_Siri_la_evolucion

Meléndez, RP, Herrera, A., Pérez, JL, & Padrón-Gómez, A. (2000). THE NEURAL MODEL OF McCULLOCH AND PITTS. Comparative Interpretation of the Model XV NATIONAL CONGRESS OF INSTRUMENTATION, Guadalajara Jalisco, Mexico.https://www.researchgate.net/publication/343141076_EL_MODELO_NEURONAL_DE_McCULLOCH_Y_PITTS_Interpretacion_Comparativa_del_Modelo

Ornelas, FAG (2020). Design and implementation of a virtual assistant (chatbot) to offer customer service to a Mexican airline through its conversational channels [Master's degree,https://infotec.repositorioinstitucional.mx/jspui/bitstream/1027/402/1/INFOTEC_MGITIC_FAGO_27082020.pdf

Rodríguez, CJZ, Macías, JAP, & Ramos, MMM (2021). Design of a building automation system for a hotel in the city of Guaranda applying HDL buspro. Knowledge Pole, 6, 478-495, Article 11.https://doi.org/10.23857/pc.v6i11.3283

Teixeira, DCA (2022). ANICE : AN ARTIFICIAL NEURO-LINGUISTIC INTERACTIVE COMPUTER ENTITY [Master, NOVA University Lisbon].https://run.unl.pt/bitstream/10362/151103/1/Teixeira_2022.pdf

Turing, A. (1950). Computing Machinery and Intelligence. Mind, 49(236), 433-460.http://www.cs.princeton.edu/~chazelle/courses/BIB/turing-intelligence.pdf

Ureña, Á. AD, & Rodríguez, EJI (2023). Implementation proposal for the use of artificial intelligence and messaging apps to improve the quality of service in customer service focused on the room and reservation management area of the Selina hotel

[Graduation thesis, University of Cuenca].http://dspace.ucuenca.edu.ec/bitstream/123456789/42617/1/Trabajo-de-Titulaci%C3%B3n.pdf

Vidal, A.E. (2007). ALAN TURING AND THE BIRTH OF ARTIFICIAL INTELLIGENCE. Telecommunication Antenna, 45-45, Article 167.https://www.bing.com/ck/a?!&&p=7b42697881ed0331JmltdHM9MTcwNTI3NjgwMCZpZ3VpZD0xMzcyMDc0MC1mODVjLTZhOWUtMmU0Mi0xNGJkZjk0MDZiNWQmaW5zaWQ9NTE5Nw&ptn=3&ver=2&hsh=3&fclid=13720740-f85c-6a9e-2e42-14bdf9406b5d&psq=ALAN+TURING+AND+THE+BIRTH+OF+ARTIFICIAL+INTELLIGENCE+Telecommunications+Antenna&u=a1aHR0cHM6Ly93d3cyLmNvaXR0LmVzL3Jlcy9yZXZpc3Rhcy9BbnRlbmExNjdfMDhiX0FydGljdWxvX0FsYW4ucGRm&ntb=1

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