Development of an AI-Powered Virtual Personal Assistant for Smart Homes

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Abstract

This Arduino-based home-automated system uses Bluetooth and an Android app with voice commands. The system strives to develop user-friendly and convenient automated appliance control. We used an Arduino ATMEGA328 microcontroller board, a Bluetooth module (HC-06), and an Android app. We wrote the Arduino in C using the IDE to control any connected component. Switching uses relays and trunks. A Google voice assistant incorporated into the Android smartphone may be used to operate the home-automated system's electrical appliances when the system is linked. The Android software, Bluetooth module, and voice prompt turn household appliances on and off. It can preset appliances to turn off for 12 hours, making the app simple to use on a smartphone. Bluetooth and Android app-based home automation simplifies appliance control. Voice commands from an Android smartphone app control appliances using an Arduino ATMEGA328 microcontroller board. The Bluetooth module (HC-06) links wirelessly to Android handsets, and the Arduino IDE instructs the microcontroller in C to control connected appliances. Relay and trunk switching can power each linked device. Users may provide hands-free orders via the app or voice instructions after connecting with the smartphone. Users may utilize Google Voice Assistant to “turn on the fan” or “switch off the lights.” The system's timer allows users to turn off appliances after 12 hours to save energy and improve safety.

Keywords: Artificial Intelligence, Voice recognition, Internet of Things, Home Automation

Introduction

A smart home is equipped with advanced technology that enables the automation and remote control of numerous household systems and equipment. National energy policy and strategic planning have prioritized the development of smart home technologies [1]. Many automated computer systems that do human functions are called "artificial intelligence" (AI). If it can detect, reason, interact, and learn like a person, it approaches or exceeds human intelligence. By using AI science, we can solve complex issues that need human intellect [2]. Artificial intelligence enhances smart home

technologies. AI may simulate user behavior using IoT data. Thus, its automatic cleaning services may be customized for each household. Integrating AI and smart home technologies will improve living conditions, labor automation, and judgment [3]. A "smart house" is an intelligent housing that adapts to its surroundings. Most current household appliances and devices were invented in the early 20th century. As technology evolves, these technologies have changed. The word "smart house" originally meant a "intelligent building" in English. We emphasize involvement. Internet, phone, and TV networks make up the contemporary interactive system [6]. Existing network connections create an appropriate network-target device interface. This interface leverages technologies including graphical user interfaces, touch displays, voice recognition, and gesture detection to facilitate human-machine communication and collaboration.

This study examines the impact of AI model developments on the design of smart homes. Modern homes include multifunctional living areas; therefore, smart home design is so important that spatial design must be adapted to meet smart home occupants' needs [9]. AI models are essential for innovative home solutions that enhance homeowners' comfort and convenience [10]. AI models automate lighting, temperature, humidity, and security system modifications, improving smart home design. Microcontrollers, intelligent control systems, and sensors may be automated for convenience and efficiency based on user behavior. Home IoT devices may use AI models. A smart control system can adjust the thermostat to the user's preference. Evidence suggests households are unaware of how thermostats affect energy consumption [11]. Building energy-efficient houses using AI is achievable. Machine learning algorithms may generate personalized energy management solutions using data from home sensors and devices. These gadgets may save energy and money by learning user preferences. Construction AI models include smart home security.

The living spaces case study uses artificial intelligence models in the design of smart homes. We examine the advantages and disadvantages of the approach. An empirical illustration demonstrates how AI models might enhance future residential architecture. AI has enabled this transition by seeing and learning from users' usage of their home's electrical devices and adjusting their settings accordingly. The residential case study advocates for the use of AI models to construct intelligent dwellings. A researcher said that contemporary intelligent systems are progressively using diverse heterogeneous sensors to provide enhanced value-added services. The plethora of sensor data and advanced AI methodologies for big data analytics may provide significant insights to assist customers in achieving well-being [12].

Proposed Work

The suggested Bluetooth-based home automation system is resilient, low-cost, and user-friendly. Our solution uses Arduino, Bluetooth, sensors, and a smartphone app. Arduino works with the Bluetooth module HC-06 and relays to link household appliances. The smartphone app communicates serially with the Bluetooth module and Arduino board. Remotely controlling appliances and monitoring sensors is the proposed technique. Today, most home automation systems are for the elderly, disabled, or special needs. One or more electronic remotes operate basic household equipment remotely and sometimes automatically. The device controls lights, entertainment, and home security systems like access control and alarms.

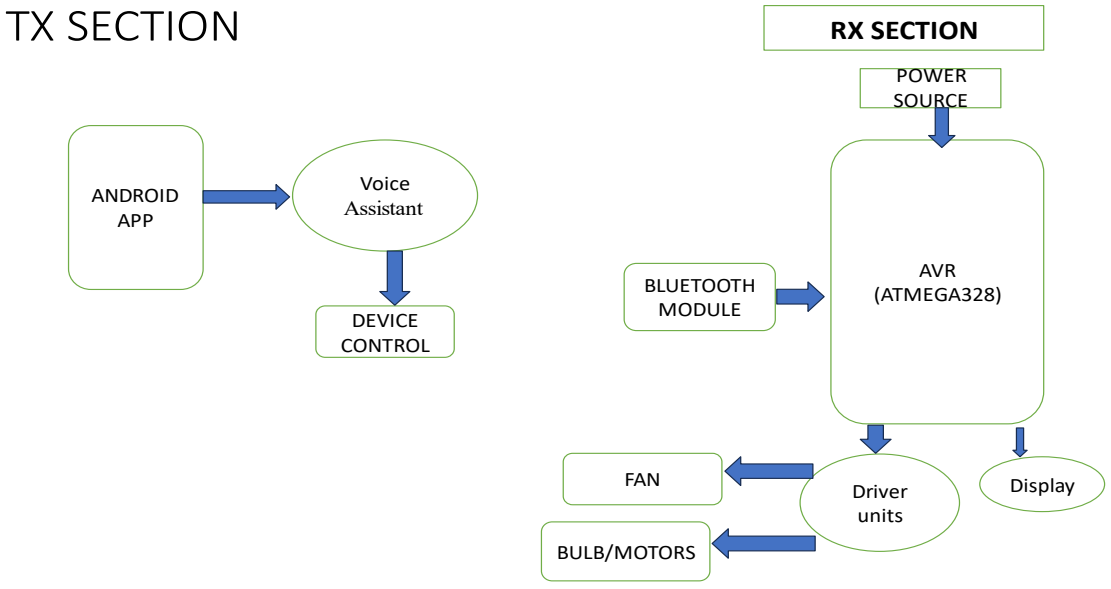


Fig 1: Block Diagram

System Components

- Arduino uno
- Bluetooth
- Driver
- Led
- Dc motor
- Power supply
- Arduino IDE,
- Embedded C.

Experimental Set-up

Arduino Uno R3 and Nano V3 are the trusted versions. These devices feature a 16MHz Atmel ATmega328P 8-bit microcontroller with 32KB of flash memory, 14 digital I/O ports, and six analog I/O ports. The 32KB will not work like Windows. Arduino creations may work alone or with computer software. Example: Flash, Processing, Max/MSP. A 16 MHz ceramic resonator and USB connection provide power and communication. Larger workloads may readily integrate micro-SD/SD card storage.

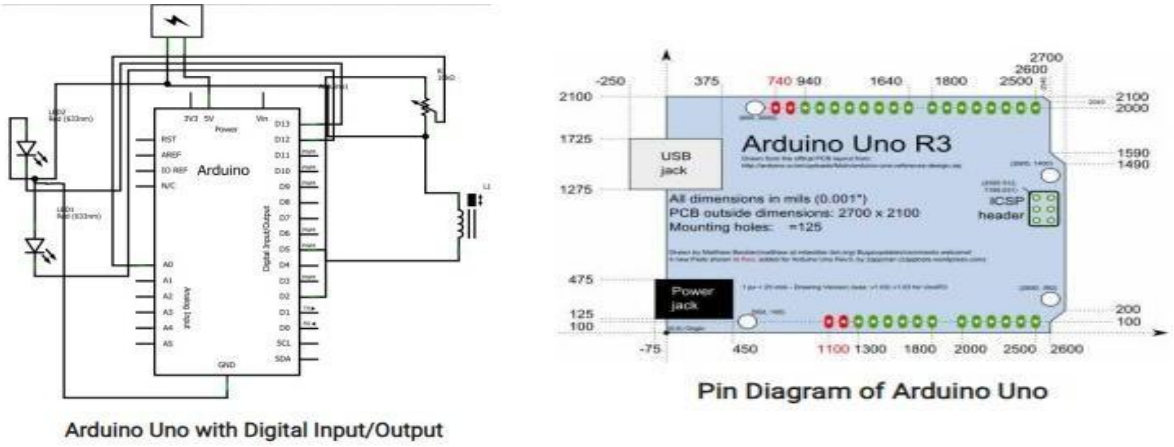
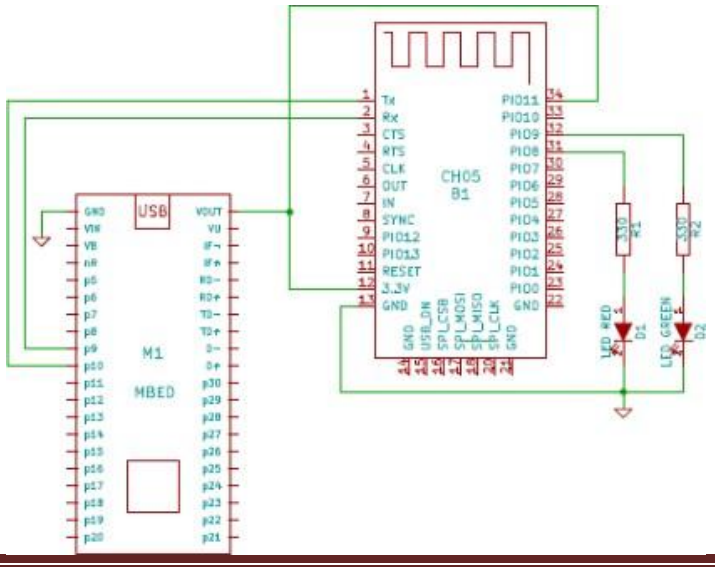


Fig 2 : Arduino uno

The HC-05 can broadcast and receive data from other Bluetooth devices in Data mode and modify default device settings in AT Command mode. The pin description describes the crucial pin, which lets us use the gadget in either mode. Since it uses Serial Port Protocol, the HC-05 module is straightforward to connect with microcontrollers. Power the module with +5V and connect its Rx and Tx pins to the MCU's Tx and Rx pins.

Fig 3: Pin configuration

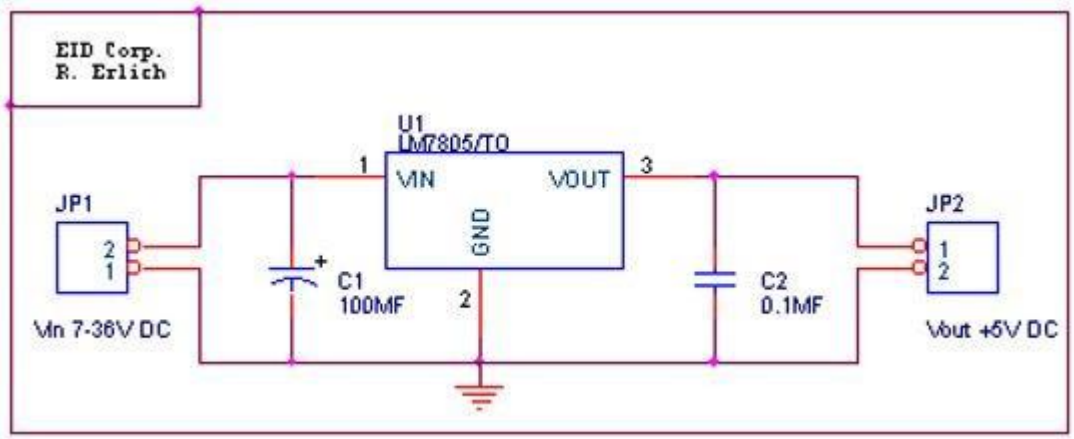


Circuit description

When working with digital electronics, it is helpful to have a tiny power supply that is capable of providing +5V output. The voltage regulation of these transformers is often rather poor, which renders them unsuitable for use in digital circuit experimentation unless a more ideal regulation can be obtained in some manner. However, these transformers are readily accessible. When enough cooling is applied to the 7805 regulator chip, this circuit is capable of producing an output of +5V at a current of around 150 mA; however, this output may be boosted to 1 A. In addition to terminal safety, the circuit provides over overload protection.

Fig 4: Circuit diagram

Results and Discussion



The findings provide evidence that the technology of intelligent voice assistants has the potential to improve day-to-day life in a number of ways, including its acceptability and efficiency. Users consider intelligent voice assistants to be useful and practical tools that can be used for a variety of activities, including the organization of chores and the accessing of digital information. An in-depth investigation into the implications of these discoveries is carried out, with a special focus on the ways in which intelligent voice assistants have the potential to change human-computer interaction and make regular jobs easier to complete. In addition, it analyzes the many ways in which digital assistants have the potential to streamline accessibility and boost productivity in a variety of settings, such as personal assistance and home automation, among others.

Conclusions

To summarize, the technology of smart voice assistants provides a realistic solution to increase accessibility as well as the performance of everyday duties. In order for it to completely achieve its potential, it is recommended that it focus on improving its ability to comprehend natural language, expanding its functioning across a wide variety of platforms and devices, and addressing any privacy concerns that may arise. Intelligent voice assistants have the potential to revolutionize the manner in which people interact with computers and provide crucial assistance in a variety of aspects of day-to-day life.

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