Automatic Greeting Machine Based on AI

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To Cite this Article

E Ashwinin, M Keerthi, R Abhiram, B Nikhitha, Mrs. K Swayam Prabha, "Automatic Greeting Machine Based on AI", Journal of Science Engineering Technology and Management Science, Vol. 03, Issue 05, May 2026, pp: 390-397, DOI: http://doi.org/10.64771/jsetms.2026.v03.i05.pp390-397

Submitted: 19-03-2026 Accepted: 25-04-2026 Published: 01-05-2026

Abstract: Human-machine interaction systems are growing more and more important in smart places like offices, schools, banks, and hospitals. This project shows an AI-based automatic greeting machine made with Arduino that greets visitors automatically based on the time of day and whether or not a person is there. An ultrasonic sensor is used by the system to find out when someone is getting close to it. A standard RT Clock (RTC) standard module is used to get the right time right now. The Arduino uses the time data to choose the best greeting message, like "Good Morning," "Good Afternoon," or "Good Evening." An LCD screen shows the chosen greeting, and the DF Mini Player component connected to a the speaker plays it at the same time. This automated greeting protocol cuts down on the need for the human receptionists and makes sure that everyone is polite and consistent. The suggested system is affordable, dependable, and works well in smart environments in real time.

I. INTRODUCTION

In today's era of smart environments, human–machine interaction (HMI) plays a crucial role in enhancing convenience, efficiency, and user experience across various sectors such as offices, educational institutions, banks, hospitals, and public service areas. Traditional reception systems require human personnel to greet visitors, which can be time-consuming, inconsistent, and prone to human error. With increasing automation and the integration of artificial intelligence (AI), it is possible to create systems that provide timely, intelligent, and context-aware interactions without continuous human intervention.

The AI-Based Automatic Greeting Machine is designed to address these challenges by providing an automated solution for visitor interaction. The system uses an ultrasonic sensor to detect the presence of a person approaching the machine. Upon detection, a Real Time Clock (RTC) module provides accurate time information, allowing the system to intelligently select an appropriate greeting based on the time of day, such as "Good Morning," "Good Afternoon," or "Good Evening."

The selected greeting is displayed on an LCD screen and simultaneously announced through a DF Mini Player module connected to a speaker, ensuring that visitors receive both visual and auditory feedback. By automating the greeting process, the system minimizes the need for human receptionists, maintains consistency, and enhances the visitor experience in a polite and professional manner.

The proposed system is cost-effective, reliable, and scalable, making it suitable for real-time deployment in smart offices, educational institutions, banks, and hospitals. By combining AI-based decision-making with simple sensor and display technologies, the system demonstrates how automation can improve human–machine interaction, reduce operational

effort, and create a more efficient and welcoming environment.

II. RELATED WORK

"AI-based Desktop Voice Assistant"

From the past few years, Artificial Intelligence (AI) has shown remarkable progress, and its future is growing day by day. Natural Language Processing (NLP) is an application of AI. A voice assistant utilizes cloud computing to integrate AI and communicate with users in natural language. In households today, millions of devices use voice assistants due to their ease of use. Universities and schools are just starting to use smart speakers with voice assistants. Voice assistants are the greatest innovation in AI that can change people's lives in a significant way. Initially, voice assistants were introduced on smartphones, then they became popular. The idea was widely accepted by all. A voice assistant was initially used in smartphones and laptops, but now it is also found in home automation systems and smart speakers. As devices become smarter, they are interfacing with humans in a language that is easier to understand. Programs based upon desktop voice assistants recognize and respond to human voices via an integrated voice system. We will discuss the main problems and limitations of voice assistants in this paper.

"A Paradigm-Based Finite State Morphological Analyzer for Marathi"

A morphological analyzer forms the foundation for many NLP applications of Indian Languages. In this paper, we propose and evaluate the morphological analyzer for Marathi, an inflectional language. The morphological analyzer exploits the efficiency and flexibility offered by finite state machines in modeling the morphotactics while using the well devised system of paradigms to handle the stem alternations intelligently by exploiting the regularity in inflectional forms. We plug the morphological analyzer with statistical pos tagger and chunker to see its impact on their performance so as to confirm its usability as a foundation for NLP applications.

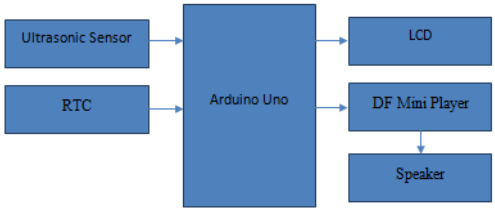
"Machine Automatic Translation System Based on Artificial Intelligence Processor Design"

In response to the problem of low accuracy in the translation process of traditional machine translation machines, the author proposes to use an artificial intelligence-based automatic machine translation model to improve the speed and accuracy of machine translation. We complete system hardware design from user design and hardware design; Using the three-layer architecture to create an English-Chinese translation network architecture, we create a sequential model to extract the main content of the English-Chinese translation, collect a dataset of these features, determine their behavior, and complete the part of the automatic special extraction algorithm, English and Chinese machine translation. According to the test results, the traditional method 1 system and traditional method 2 have the highest accuracy of 94.4 and 94.7 in the number of iterations and equipment overuse. In practice, the number of iterations can be increased to 200, and the accuracy of 98.4 can be achieved, which can meet the actual needs. Machine translation based on artificial intelligence technology has improved the speed and accuracy of sentence translation compared to text-based machine translation.

III. IMPLEMENTATION

The proposed **AI Based Automatic Greeting Machine** uses an **Arduino microcontroller** integrated with an **ultrasonic sensor, RTC module, LCD display, and DF Mini Player**. The ultrasonic sensor detects the presence of a person within a predefined distance. Once a person is detected, the Arduino reads the current time from the RTC module and categorizes it into morning, afternoon, or evening. Based on this classification, an appropriate greeting message is selected. The greeting is displayed on the LCD and played as a **voice message** through the DF Mini Player and speaker. Although the system is rule-based, it exhibits intelligent behavior by adapting greetings dynamically according to real-time conditions. This system reduces manpower requirements and improves user interaction in public and private spaces.

Block diagram:



Working

The AI-Based Automatic Greeting Machine operates by combining sensors and time-based intelligence to provide polite, automated interactions. An ultrasonic

sensor detects when a person approaches, while a Real Time Clock (RTC) module supplies accurate time data to the Arduino microcontroller. Based on this input, the system selects an appropriate greeting such as "Good Morning," "Good Afternoon," or "Good Evening." The chosen message is displayed on an LCD screen and simultaneously announced through a DF Mini Player connected to a speaker. This setup ensures consistent, time-sensitive greetings without human intervention, making it a cost-effective, reliable, and practical solution for smart environments like offices, schools, banks, and hospitals.

HARDWARE REQUIREMENTS

ARDUINO

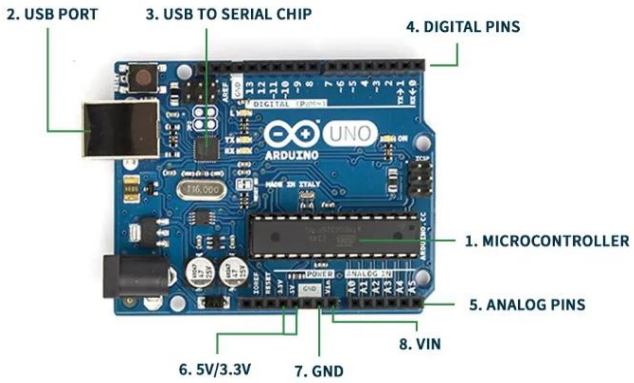
The Arduino is one of the most popular and widely used Arduino boards. It's based on the ATmega328P microcontroller and offers a good balance of features, performance, and affordability, making it suitable for a wide range of projects, from simple to moderately complex.

Most electronic devices involve circuit-making using hardware components. The purpose of introducing Arduino was to make an easy-to-use device that can offer the feature of programming along with circuit making. Therefore, Arduino is a programmable device that is used mostly by artists, designers, engineers, hobbyists, and anyone who wants to explore programming in electronics.

The Arduino uses its components to gather information from the surroundings and generate a precise output accordingly. The information is gathered using some components like sensors, and input pins, and an output is generated depending on the programming done. This output can range from illuminating an LED to turning the motors on.

Arduino are great devices that can be used for creating interactive projects. They can either be used alone to create basic projects or they can be integrated with Arduino, Raspberry Pi Pico , Node MCU, or nearly anything else using some programming in their software to create some advanced level of projects. It is good to know the specifications of different Arduino so that you can select the right Arduino for your project.

Arduino Hardware
Let us look at the hardware components of Arduino:



- **Microcontroller: The** Microcontroller controls the execution of all the programs and codes uploaded on Arduino. The microcontroller is equipped with components that can perform different functions.
- **USB port:** This port is used to establish a connection between the computer and the Arduino board.
- **USB to Serial chip: The** USB to Serial port is used for adding data from the computer to the microcontroller. This is how the code is uploaded from the computer to the Arduino board.
- **Digital pins**: These pins are used for turning the LEDs on and off by using digital logic ('0' and '1').
- **Analog pins:** These pins are used for taking analog input.
- **5V / 3.3V pins**: These pins are used for supplying power to devices.
- **GND:** This pin is used for setting a reference level.

ULTRASONIC SENSOR

Ultrasonic sensors are electronic devices that calculate the target's distance by emission of ultrasonic sound waves and convert those waves into electrical signals. The speed of emitted ultrasonic waves traveling speed is faster than the audible sound. There are mainly two essential elements which are the transmitter and receiver. Using the piezoelectric crystals, the transmitter generates sound, and from there it travels to the target and gets back to the receiver component.

To know the distance between the target and the sensor, the sensor calculates the amount of time required for sound emission to travel from transmitter to receiver. The calculation is done as follows:

D = 1/2 T * C

Where 'T' corresponds to time measured in seconds

'C' corresponds to sound speed = 343 measured in mts/sec

Ultrasonic sensor working principle is either similar to sonar or radar which evaluates the target/object attributes by understanding the received echoes from sound/radio waves correspondingly. These sensors produce high-frequency sound waves and analyse the echo which is received from the sensor. The sensors measure the time interval between transmitted and received echoes so that the distance to the target is known.

Ultrasonic Sensor Specifications

Knowing the specifications of an ultrasonic sensor helps in understanding the reliable approximations of distance measurements.

- The sensing range lies between 40 cm to 300 cm.
- The response time is between 50 milliseconds to 200 milliseconds.
- The Beam angle is around $5^{0.}$
- It operates within the voltage range of 20 VDC to 30 VDC
- Preciseness is ±5%
- The frequency of the ultrasound wave is 120 kHz
- Resolution is 1mm
- The voltage of sensor output is between 0 VDC – 10 VDC
- The ultrasonic sensor weight nearly 150 grams
- Ambient temperature is -25^0C to $+70^0$C
- The target dimensions to measure maximum distance is 5 cm × 5 cm

The ultrasonic sensor pin diagram is:

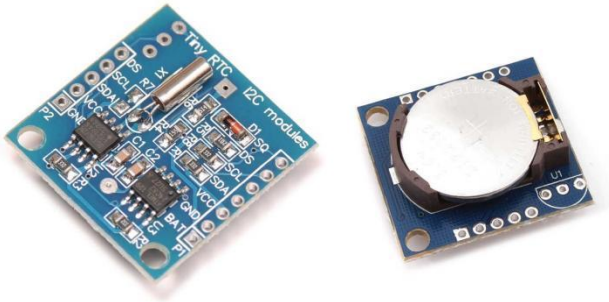
RTC

A real-time clock (RTC) is a computer clock, usually in the form of an integrated circuit that is solely built for keeping time. Naturally, it counts hours, minutes, seconds, months, days and even years. RTCs can be found running in personal computers, embedded systems and servers, and are present in any electronic device that may require accurate time keeping. Being able to still function even when the computer is powered down through a battery or independently from the system's main power is fundamental.

RTCs must accurately keep time, even when the device is powered off because, it is often used as a trigger for turning the device on or triggering events such as alarm clocks. RTC ICs run on an alternate power source, which allows it to continually operate under low power or even when the computer is turned off. ICs on older systems utilize lithium batteries, whereas newer systems make use of auxiliary batteries or supercapacitors. RTC ICs that use supercapacitors are rechargeable and can be soldered. But in most consumer-grade motherboards, the RTC is powered by a single battery that, when removed, resets the RTC to its starting point.

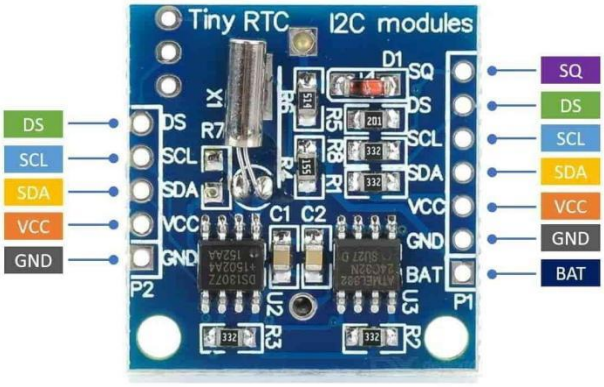
RTC ICs regulate time with the use of a crystal oscillator and do not rely on clock signals like most hardware clocks. Aside from being responsible for the timing function of the system and its clock, RTC ICs ensure that all processes occurring in the system are appropriately synchronized. Although some may argue that this is a job for the system clock, the system clock is actually dependent on the RTC, making the RTC indirectly responsible for synchronization.

An RTC battery should last for three to five years or more. RTCs are essential; if the battery fails, it must be replaced to ensure continued operation. A dead battery can be diagnosed with an error message at startup or if the user finds that the clock or the setup configuration has become corrupted, flaky or odd.



DS1307 RTC Module

Pinout of DS1307 RTC Module



Pinout of DS1307 RTC Module

DS1307 RTC Module Pin Description

The DS1307 RTC (Real-Time Clock) module typically has 8 pins. The pin description is as follows:

1. VCC: Power supply pin, usually connected to 5V or 3.3V
2. GND: Ground pin
3. SDA: I2C data pin, connected to the microcontroller's SDA pin.
4. SCL: I2C clock pin, connected to the microcontroller's SCL pin.
5. SQW: Square wave output pin, used to output a square wave signal with a frequency of 1Hz, 4kHz, 8kHz, or 32kHz.

LCD

LCD is a flat display technology, stands for "Liquid Crystal Display," which is generally used in computer monitors, instrument panels, cell phones, digital cameras, TVs, laptops, tablets, and calculators. It is a thin display device that offers support for large resolutions and better picture quality. The older CRT display technology has replaced by LCDs, and new display technologies like OLEDs have started to replace LCDs. An LCD display is most commonly found with Dell laptop computers and is available as an active-matrix, passive-matrix, or dual-scan display. The picture is an example of an LCD computer monitor.

The Liquid Crystal library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

Output of the sketch on a 16x2 LCD

The LCDs have a parallel interface, meaning that the microcontroller has to manipulate several interface pins at once to control the display. The interface consists of the following pins:

- A **register select (RS) pin** that controls where in the LCD's memory you're writing data to. You can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next.
- A **Read/Write (R/W) pin** that selects reading mode or writing mode
- An **Enable pin** that enables writing to the registers
- 8 **data pins (D0 -D7)**. The states of these pins (high or low) are the bits that you're writing to a register when you write, or the values you're reading when you read.

There's also a display contrast pin (Vo), power supply pins (+5V and GND) and LED Backlight (Bklt+ and BKlt-) pins that you can use to power the LCD, control the display contrast, and turn on and off the LED backlight, respectively.

The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. The Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions.

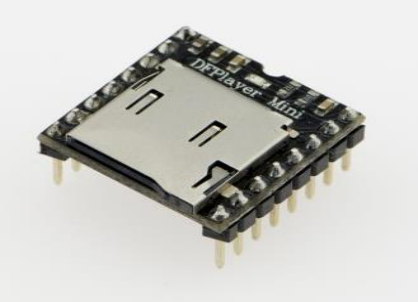
The Hitachi-compatible LCDs can be controlled in two modes: 4-bit or 8-bit. The 4-bit mode requires seven I/O pins from the Arduino, while the 8-bit mode requires 11 pins. For displaying text on the screen, you can do most everything in 4-bit mode, so example shows how to control a 16x2 LCD in 4-bit mode.

LCD Pin Description:
The LCD requires 3 control lines (RS, R/W, and EN) and 8(or 4) data lines. The number of data lines depends on the mode of operation. If operated in 8-bit mode then 8-bit data lines are required. And if the operation is in 4-bit mode then 4-bit data lines are required. The 8-bit mode is faster than the 4-bit mode. In 8-bit mode, LCD uses a total of 14 pins including 8 data lines, 3 control lines, and 3 power supply lines (Vee Vss and Vee)

1. **Power Supply:** The LCD discussed here uses three power supply pins (Vcc, Vss, and Vee) Vcc and Vss pins are used to provide +5V and ground respectively. The pin Vee is used for controlling LCD contrast.
2. **Control Lines:** There are three control lines in the LCD. These three are used to control the LCD operations there are two very important registers inside the LCD: the command register and the data register. The RS (Register select) pin is used to select the register out of these two. If RS = 0 the command register is selected and the user is allowed to send the command to the LCD. If RS = 1, the data register is selected and the data sent by the user is displayed on the LCD.
   R / W (Read/ Write) pin allows the user to read/write the information (data or code) to/ from the LCD. R /W = 1 when reading and R/W=0 when the writing operation is performed.
   Another control pin EN (Enable) is used to latch the data present on the data pins. A high-low signal is required to latch the data. The LCD interprets and executes the commands at the instant the EN line is brought low.
3. **Data lines:** The 8-bits data pins. D (0)-D (7) are used to send the information to the LCD or read the contents of the LCD's internal register.

DF PLAYER MINI

The **DFPlayer Mini** is a small, low-cost MP3 module that allows users to add audio playback capabilities directly to DIY electronics projects, such as those built with Arduino, Raspberry Pi, or ESP32. It is highly popular for its built-in 3W amplifier and MicroSD card slot, allowing it to directly drive a small speaker without needing an external audio amplifier.



SPEAKER

A **speaker module** is an electronic output device used to convert **electrical audio signals into audible sound**. In embedded systems and microcontroller-based projects, a speaker module is commonly used to provide **voice messages, alerts, alarms, and notifications**. It is widely used in assistive devices, security systems, and IoT applications.

In projects like the **Bus Identification System for the Blind**, the speaker module plays a crucial role by delivering **clear audio announcements** to help visually impaired users receive information without relying on visual displays.

IV. RESULT ANALYSIS

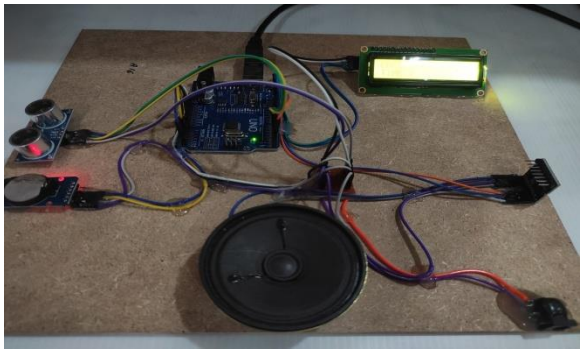


Fig1: project kit

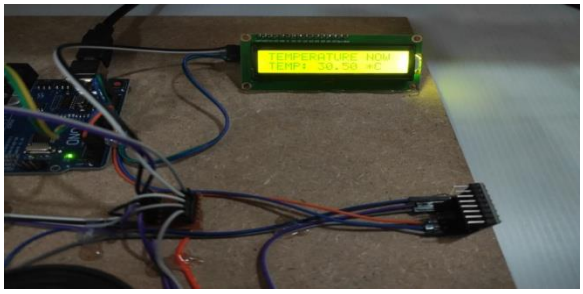


Fig2: temperature levels

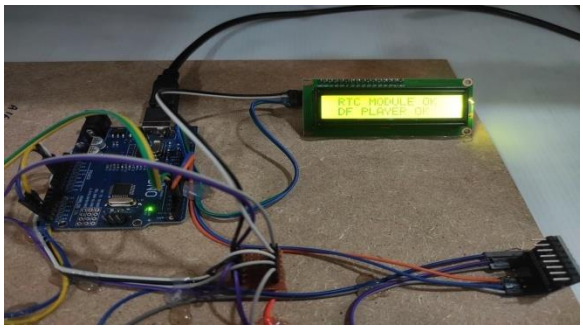


Fig3: device on status

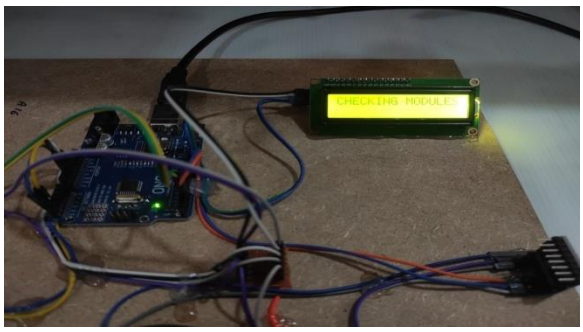


Fig4: checking module

V. CONCLUSION

The AI-Based Automatic Greeting Machine provides an effective and practical solution to enhance human–machine interaction in smart environments such as offices, educational institutions, banks, and hospitals. By combining ultrasonic sensing, real-time clock monitoring, and intelligent decision-making, the system automatically detects visitors and delivers context-aware greetings based on the time of day.

The integration of an LCD display and DF Mini Player module ensures that greetings are both visually and audibly communicated, offering a professional and welcoming experience. This automation reduces the dependency on human receptionists, maintains consistency in visitor interactions, and improves overall efficiency in managing visitor engagement.

The proposed system is cost-effective, reliable, and scalable, making it suitable for real-time deployment in a variety of smart environments. By leveraging AI-based logic in a simple embedded platform like Arduino, the project demonstrates how technology can enhance daily operations, improve user experience, and contribute to a more intelligent and interactive environment.

In conclusion, the AI-Based Automatic Greeting Machine is a step towards fully automated, intelligent reception systems and highlights the potential of AI and IoT technologies in creating smarter, more efficient, and user-friendly spaces.

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