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Design and Fabrication of Mini Serving Robot

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Abstract: ***Serving robots as emerging service providers, in combination with novel technologies like artificial intelligence, have the potential to enhance service outcomes and customer experience and may already be transforming the service delivery process. At present, the study focused on service robots has matured sufficiently to warrant an overview of the research on the ways in which service robots have been employed. This study conducts a systematic literature review of the academic corpus focused on service robots (N = 28). We report the research methods, application contexts and robot types of service robot research to understand how service robots participate in service delivery, what technological characteristics of service robots are commonly analyzed, and the potential service outcomes of service robot use. This review shows that overall, service robots have a high potential to delivery services in service contexts, and will be widely used and bring more rich service experience to people.***

I. INTRODUCTION

In recent years, technological advancements have drastically transformed various industries, and one of the most significant changes has been in the field of home automation. As part of the Internet of Things (IoT) revolution, the idea of a Mini Serving Robot has become an increasingly popular concept. The main goal of a smart home robot is to improve the quality of life by automating various tasks, improving security, and enhancing convenience and energy efficiency. The rise of artificial intelligence (AI), machine learning, robotics, and IoT has paved the way for autonomous robots to become an integral part of modern households, making daily living more efficient and comfortable. The notion of Mini Serving Robot involves the creation of an autonomous system capable of performing household chores, providing security services, and supporting individuals with mobility or health-related challenges. The robot can execute a wide range of tasks, such as cleaning, delivering items, monitoring the house for intruders, or providing real-time assistance to the elderly and disabled. It can also serve as an interactive, multifunctional device that integrates seamlessly with other smart devices and home systems.

The combination of these capabilities offers immense value, making smart robots an essential addition to the smart home ecosystem. This introduction will explore the technological foundations that make the Mini Serving Robot possible, its various features and functionalities, and the impact it has on daily living and home management. The paper will also examine the benefits of incorporating such systems into homes, highlighting their potential to improve security, reduce human effort, and increase overall efficiency. Through the integration of various smart technologies, the home robot offers a practical and futuristic solution to many of the challenges faced by modern households.

II. LITERATURE REVIEW

1) The Roomba is a robotic vacuum cleaner that uses sensors to navigate the home and clean floors. Studies (Seong et al., 2012) highlight the device's autonomous cleaning capabilities and its ability to navigate around obstacles and return to charging stations autonomously. However, challenges persist in terms of mapping efficiency, dust collection power, and the device's ability to clean complex areas such as corners or edges.

2) Intelligent Cleaning Robots: A variety of studies (Abdullah et al., 2017) have focused on improving the intelligent behavior of cleaning robots, using technologies such as artificial neural networks (ANNs) and deep learning algorithms. These robots not only perform cleaning tasks but can also adapt to changes in the home environment, avoiding obstacles and detecting dirtier areas that need more attention.

3) Security Robots: Research by Bohannon et al. (2019) suggests that mobile robots used for security purposes can autonomously patrol a property, providing live video feeds and triggering alarms when unauthorized motion or entry is detected. The integration of AI-based vision systems (Zhang et al., 2019) allows robots to identify potential threats and human faces, making these systems more intelligent and adaptive.

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III. SOFTWARE INSTALLATION

Arduino IDE Software. You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.

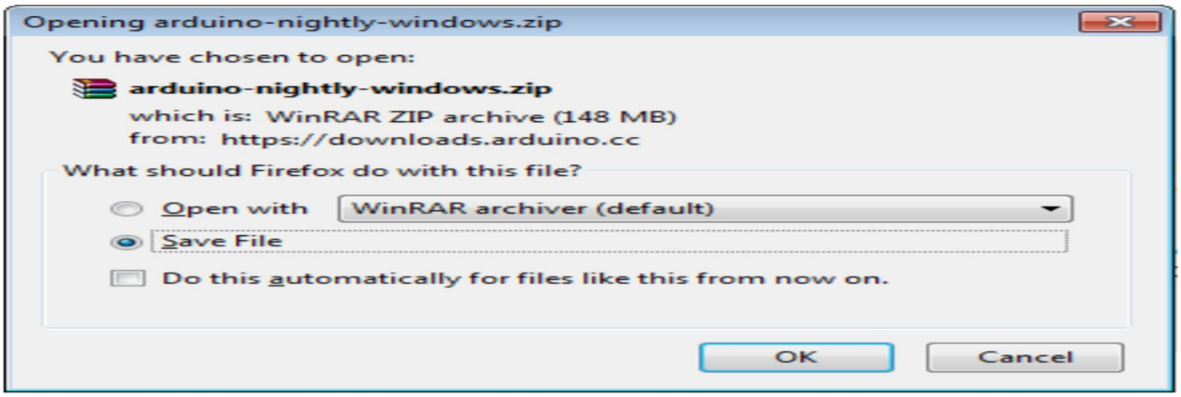


Fig. Opening arduino-nightly-windows.zip

Launch Arduino IDE. After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Double click the icon to start the IDE.

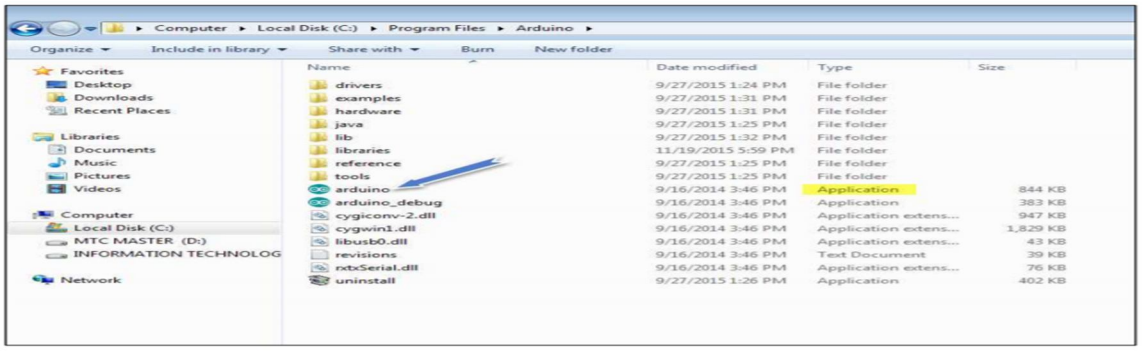


Fig: Launch Arduino IDE

Open your first project. Once the software starts, you have two options: Create a new project. Open an existing project example. To create a new project, select File --> New

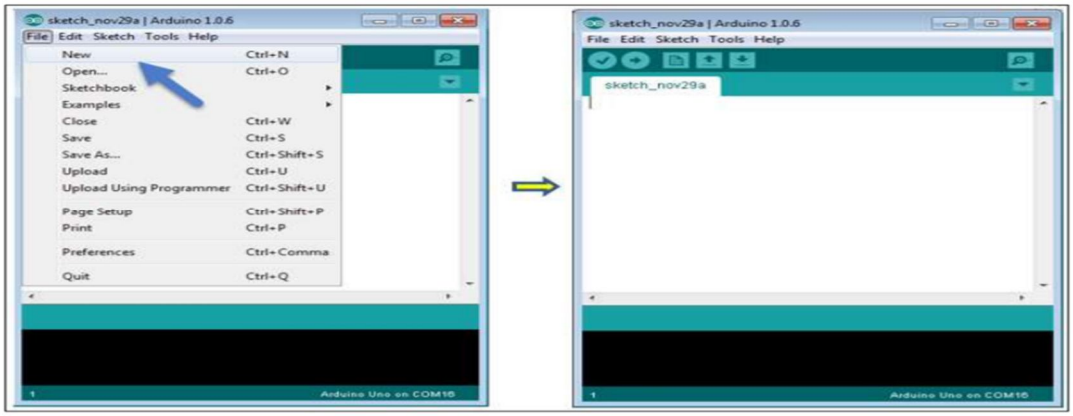


Fig: Create a new project

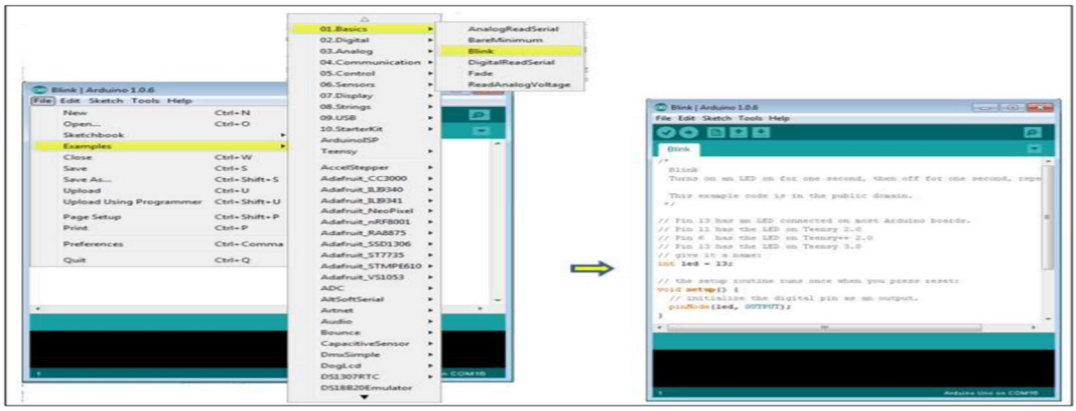


Fig: Open an existing project example

Here, we are selecting just one of the examples with the name Blink. It turns the LED on and off with some time delay. You can select any other example from the list Select your serial port. Select the serial device of the Arduino board. Go to Tools -> Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

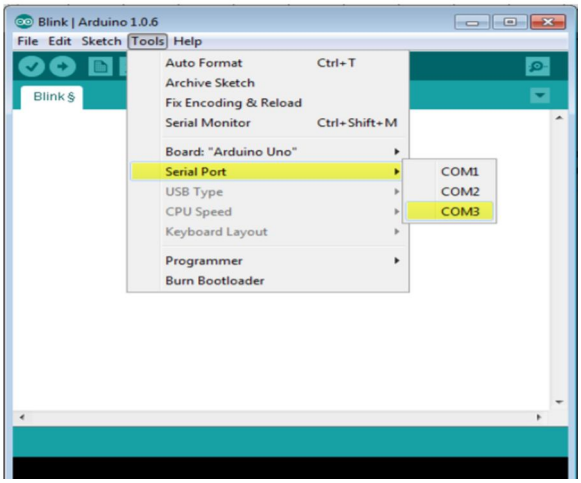


Fig: Select your serial port

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar. A- Used to check if there is any compilation error. B- Used to upload a program to the Arduino board. C- Shortcut used to create a new sketch. D- Used to directly open one of the example sketch. E- Used to save your sketch. F- Serial monitor used to receive serial data from the board and send the serial data to the board. Now, simply click the "Upload" button in the environment. Wait a few seconds; you will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message "Done uploading" will appear in the status bar.

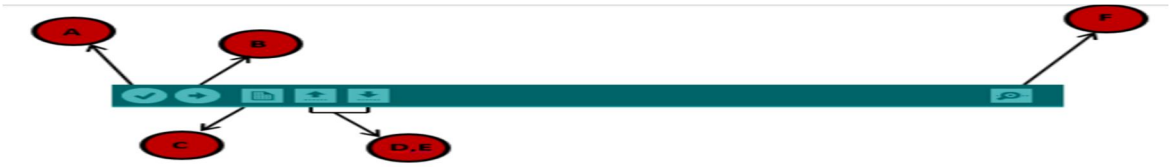


Fig: function of each symbol appearing in the Arduino IDE toolbar

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In this chapter, we will study in depth, the Arduino program structure and we will learn more new terminologies used in the Arduino world. The Arduino software is open-source. The source code for the Java environment is released under the GPL and the C/C++ microcontroller libraries are under the LGPL. Sketch: The first new terminology is the Arduino program called “sketch”. Structure Arduino programs can be divided in three main parts: Structure, Values (variables and constants), and Functions. In this tutorial, we will learn about the Arduino software program, step by step, and how we can write the program without any syntax or compilation error. Let us start with the Structure. Software structure consist of two main functions: Setup( ) function Loop( ) function

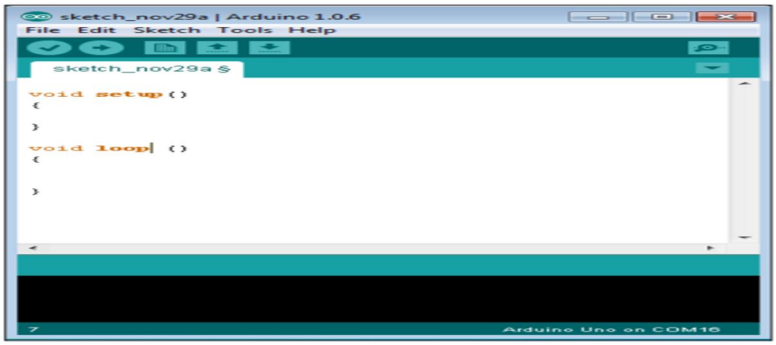


Fig: Bare minimum code

Data types in C refer to an extensive system used for declaring variables or functions of different types. The type of a variable determines how much space it occupies in the storage and how the bit pattern stored is interpreted. The following table provides all the data types that you will use during Arduino programming.

IV. RESULT

The Smart Robot at Home represents a significant step forward in the evolution of home automation and intelligent living spaces. By integrating cutting-edge technologies like Artificial Intelligence (AI), the Internet of Things (IoT), robotics, and machine learning, these robots bring efficiency, convenience, and safety to households. They can perform a variety of tasks, ranging from cleaning and security monitoring to providing assistance for people with limited mobility and elderly care. The ability to navigate autonomously using sensors like cameras, ultrasonic, and proximity sensors allows the robot to adapt to different environments, avoid obstacles, and make intelligent decisions in real time.



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V. CONCLUSION

The proposed system offers a user-friendly interface, such as voice control and mobile app integration, making it accessible for everyone, including non-technical users. The robot can interact with other smart home devices, contributing to the seamless integration of household systems, enhancing the overall efficiency and energy management of the home. In addition to reducing the burden of repetitive tasks, it adds an extra layer of security by monitoring the premises, sending alerts, and even assisting in emergency situations. In conclusion, the Smart Robot at Home is not just a technological innovation but a practical solution to the evolving needs of modern households. As smart homes continue to gain popularity, robots like these are expected to become an integral part of everyday life, offering substantial improvements in comfort, security, and quality of life. With ongoing advancements in AI and robotics, the future holds the promise of even more sophisticated and versatile robots that will further transform how we live and interact with our living spaces.

VI. FUTURE SCOPE

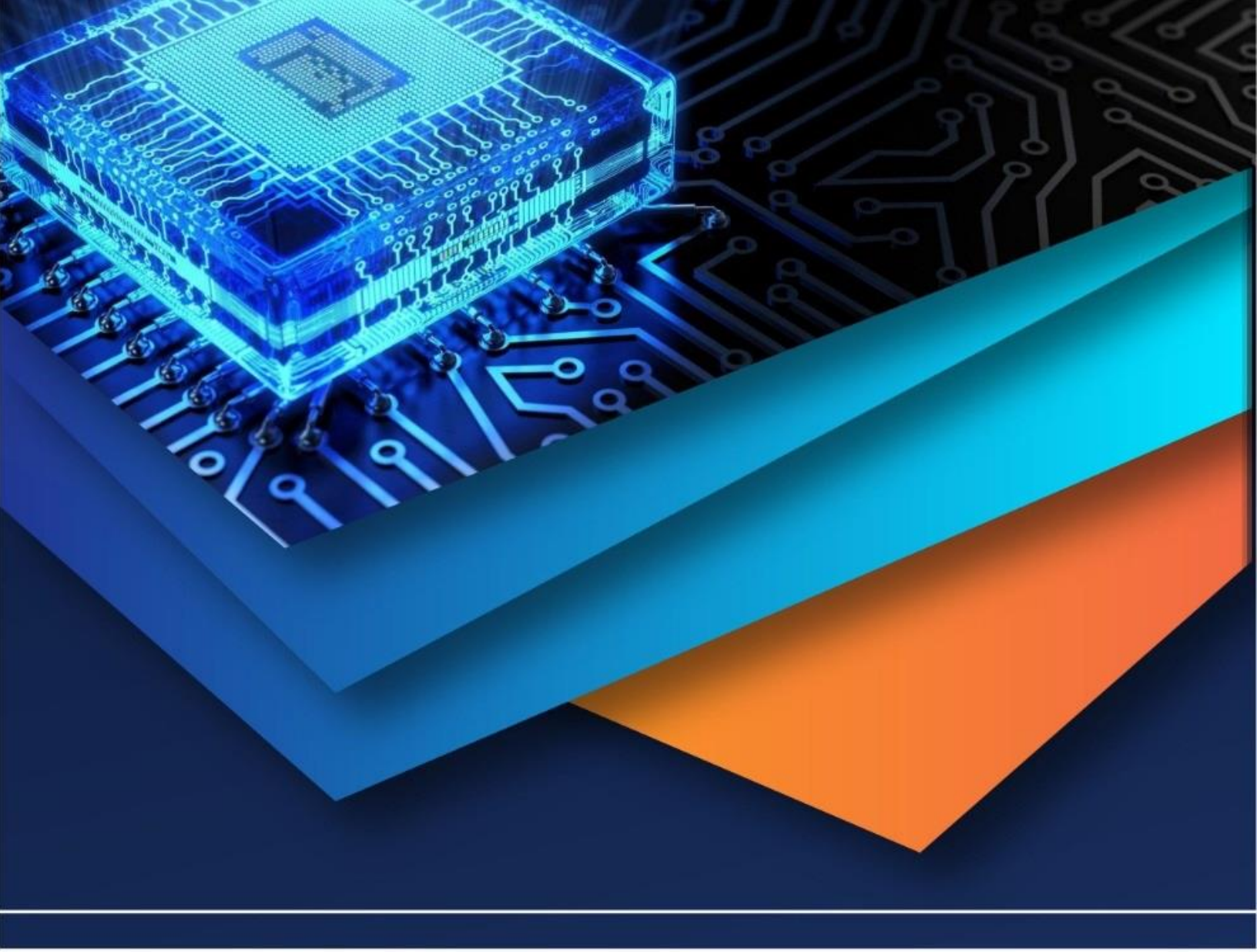
The future scope of service robots is vast and promising, with potential advancements in various areas: Future Scope of Service Robots Advancements in Technology

1) Artificial Intelligence (AI): Service robots will become more intelligent, enabling them to learn, adapt, and make decisions autonomously.
2) Machine Learning (ML): Robots will be able to improve their performance over time, adapting to new situations and environments.
3) Computer Vision: Robots will be able to perceive and understand their environment, enabling them to navigate and interact with humans more effectively.

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