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SPEECH-BASED MULTI DISPENSER SYSTEM

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ABSTRACT

The speech-based multi dispenser system is an innovative project that integrates speech recognition, artificial intelligence (AI), machine learning (ML), and Raspberry Pi to create a smart liquid dispensing solution. The system aims to provide convenient and precise control over the dispensing based on voice commands from the user. The project utilizes a Raspberry Pi as the central control unit, along with a motor driver IC (such as L293D) to control the dispensing mechanism. The system incorporates a microphone to capture voice commands, which are processed using AI and ML algorithms to accurately recognize and interpret the user's instructions. Upon receiving a valid voice command, the system translates it into specific actions for the motor driver IC. The motor driver IC controls the motors responsible for dispensing, enabling accurate and controlled dispensing according to the user's request.

Additionally, the project is complemented with a mobile app interface that displays the status of the motors. The advantages of the speech-based multi-liquid dispenser system include ease of use, hands-free operation, precise liquid dispensing, remote control capabilities, and the ability to customize and monitor dispensing settings. The project opens up possibilities for various applications such as automated beverage dispensing, chemical mixing, pharmaceutical preparations, and more. By incorporating AI and ML techniques, the system can continuously improve its voice recognition capabilities and adapt to user preferences over time. The integration of Raspberry Pi and motor driver IC allows for seamless control and automation of the dispensing process.

Overall, the speech-based multi dispenser system offers a user-friendly and intelligent solution for precise liquid dispensing, combining the power of voice recognition, AI, ML, and Raspberry Pi to enhance convenience and efficiency in various dispensing applications.

INTRODUCTION

INTRODUCTION TO SPEECH-BASED MULTI DISPENSER SYSTEM

1.1 Introduction of Embedded System

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. A good example is the microwave oven. Almost every household has one, and tens of millions of them are used every day, but very few people realize that a processor and software are involved in the preparation of their lunch or dinner.

This is in direct contrast to the personal computer in the family room. It too is comprised of computer hardware and software and mechanical components (disk drives, for example). However, a personal computer is not designed to perform a specific function rather; it is able to do many different things. Many people use the term general-purpose computer to make this distinction clear. As shipped, a general-purpose computer is a blank slate; the manufacturer does not know what the customer will do wish it. One customer may use it for a network file server another may use it exclusively for playing games, and a third may use it to write the next great American novel.

Frequently, an embedded system is a component within some larger system. For example, modern cars and trucks contain many embedded systems. One embedded system controls the anti-lock brakes, other monitors and controls the vehicle's emissions, and a third displays information on the dashboard.

In some cases, these embedded systems are connected by some sort of a communication network, but that is certainly not a requirement.

At the possible risk of confusing you, it is important to point out that a general-purpose computer is itself made up of numerous embedded systems. For example, my computer consists of a keyboard, mouse, video card, modem, hard drive, floppy drive, and sound card-each of Which is an embedded system? Each of these devices contains a processor and software and is designed to perform a specific function. For example, the modem is designed to send and receive digital data over analog telephone line. That is, it and all of the other devices can be summarized in a single sentence as well.

If an embedded system is designed well, the existence of the processor and software could be completely unnoticed by the user of the device. Such is the case for a microwave oven, VCR, or alarm clock. In some cases, it would even be possible to build an equivalent device that does not contain the processor and software. This could be done by replacing the combination with a custom integrated circuit that performs the same functions in hardware. However, a lot of flexibility is lost when a design is hard-cooled in this way. It is much easier, and cheaper, to change a few lines of software than to redesign a piece of custom hardware.

1.2 History and Future

Given the definition of embedded systems earlier is this chapter; the first such systems could not possibly have appeared before 1971. That was the year Intel introduced the world's first microprocessor. This chip, the 4004, was designed for use in a line of business calculators produced by the Japanese Company Busicom. In 1969, Busicom asked Intel to design a set of custom integrated circuits-one for each of their new calculator models. The 4004 was Intel's response rather than design custom hardware for each calculator, Intel proposed a general-purpose circuit that could be used throughout the entire line of calculators. Intel's idea was that the software would give each calculator its unique set of features.

The microcontroller was an overnight success, and its use increased steadily over the next decade. Early embedded applications included unmanned space probes, computerized traffic lights, and aircraft flight control systems. In the 1980s, embedded systems quietly rode the waves of the microcomputer age and brought microprocessors into every part of our kitchens (bread machines, food processors, and microwave ovens), living rooms (televisions, stereos, and remote controls), and workplaces (fax machines, pagers, laser printers, cash registers, and credit card readers).

It seems inevitable that the number of embedded systems will continue to increase rapidly. Already there are promising new embedded devices that have enormous market potential; light switches and thermostats that can be central computer, intelligent air-bag systems that don't inflate when children or small adults are present, pal-sized electronic organizers and personal digital assistants (PDAs), digital cameras, and dashboard navigation systems. Clearly, individuals who possess the skills and desire to design the next generation of embedded systems will be in demand for quite some time.

1.3 Real Time Systems

One subclass of embedded is worthy of an introduction at this point. As commonly defined, a real-time system is a computer system that has timing constraints. In other words, a real-time system is partly specified in terms of its ability to make certain calculations or decisions in a timely manner. These important calculations are said to have deadlines for completion. And, for all practical purposes, a missed deadline is just as bad as a wrong answer.

The issue of what if a deadline is missed is a crucial one. For example, if the real-time system is part of an airplane's flight control system, it is possible for the lives of the passengers and crew to be endangered by a single missed deadline. However, if instead the system is involved in satellite communication, the damage could be limited to a single corrupt data packet. The more severe the consequences, the more likely it will be said that the deadline is "hard" and thus, the system is a hard real-time system. Real-time systems at the other end of this discussion are said to have "soft" deadlines.

All of the topics and examples presented in this book are applicable to the designers of real-time system who is more delight in his work. He must guarantee reliable operation of the software and hardware under all the possible conditions and to the degree that human lives depend upon three system's proper execution, engineering calculations and descriptive paperwork.

• Consumer appliances : At home we use a number of embedded systems which include digital camera, digital diary, DVD player, electronic toys, microwave oven, remote controls for TV and air-conditioner, VCO player, video game consoles, video recorders etc. Today's high-tech car has about 20 embedded systems for transmission control, engine spark control, air-conditioning, navigation etc. Even wristwatches are now becoming embedded systems. The palmtops are powerful embedded systems using which we can carry out many general-purpose tasks such as playing games and word processing.

• Industrial automation: Today a lot of industries use embedded systems for process control. These include pharmaceutical, cement, sugar, oil exploration, nuclear energy, electricity generation and transmission. The embedded systems for industrial use are designed to carry out specific tasks such as monitoring the temperature, pressure, humidity, voltage, current etc., and then take appropriate action based on the monitored levels to control other devices or to send information to a centralized monitoring station. In hazardous industrial environment, where human presence has to be avoided, robots are used, which are programmed to do specific jobs. The robots are now becoming very powerful and carry out many interesting and complicated tasks such as hardware assembly.

• Medical electronics: Almost every medical equipment in the hospital is an embedded system. These equipment's include diagnostic aids such as ECG, EEG, blood pressure measuring devices, X-ray scanners; equipment used in blood analysis, radiation, colonoscopy, endoscopy etc. Developments in medical electronics have paved way for more accurate diagnosis of diseases.

• Computer networking: Computer networking products such as bridges, routers, Integrated Services Digital Networks (ISDN), Asynchronous Transfer Mode (ATM), X.25 and frame relay switches are embedded systems which implement the necessary data communication protocols. For example, a router interconnects two networks. The two networks may be running different protocol stacks. The router's function is to obtain the data packets from incoming pores, analyze the packets and send them towards the destination after doing necessary protocol conversion. Most networking equipment's, other than the end systems (desktop computers) we use to access the networks, are embedded systems.

• Telecommunications: In the field of telecommunications, the embedded systems can be categorized as subscriber terminals and network equipment. The subscriber terminals such as key telephones, ISDN phones, terminal adapters, web cameras are embedded systems. The network equipment includes multiplexers, multiple access systems, Packet Assemblers Dissemblers (PADs), sate11ite modems etc. IP phone, IP gateway, IP gatekeeper etc. are the latest embedded systems that provide very low-cost voice communication over the Internet.

• Wireless technologies: Advances in mobile communications are paving way for many interesting applications using embedded systems. The mobile phone is one of the marvels of the last decade of the 20'h century. It is a very powerful embedded system that provides voice communication while we are on the move. The Personal Digital Assistants and the palmtops can now be used to access multimedia services over the Internet. Mobile communication infrastructure such as base station controllers, mobile switching centers are also powerful embedded systems.

• Security: Security of persons and information has always been a major issue. We need to protect our homes and offices; and, the information we transmit and store. Developing embedded systems for security applications is one of the most lucrative businesses nowadays. Security devices at homes, offices, airports etc. for authentication and verification are embedded systems. Encryption devices are nearly 99 per cent of the processors that are manufactured end up in~ embedded systems. Embedded systems find applications in. every industrial segment- consumer electronics, transportation, avionics, biomedical engineering, manufacturing, process control and industrial automation, data communication, telecommunication, defence, security etc. Used to encrypt the data/voice being transmitted on communication links such as telephone lines. Biometric systems using fingerprint and face recognition are now being extensively used for user authentication in banking applications as well as for access control in high security buildings.

• Finance: Financial dealing through cash and cheques are now slowly paving way for transactions using smart cards and ATM (Automatic Teller Machine, also expanded as Any Time Money) machines. Smart card, of the size of a credit card, has a small micro-controller and memory; and it interacts with the smart card reader! ATM machine and acts as an electronic wallet. Smart card technology has the capability of ushering in a cashless society. Well, the list goes on. It is no exaggeration to say that eyes wherever you go, you can see, or at least feel, the work of an embedded system.

1.4 Overview of Embedded System Architecture

Every embedded system consists of custom-built hardware built around a Central Processing Unit (CPU). This hardware also contains memory chips onto which the software is loaded. The software residing on the memory chip is also called the ‘firmware’. The embedded system architecture can be represented as a layered architecture as shown in Fig. The operating system runs above the hardware, and the application software runs above the operating system.

For small appliances such as remote control units, air conditioners, toys etc., there is no need for an operating system and you can write only the software specific to that application. For applications involving complex processing, it is advisable to have an operating system. In such a case, you need to integrate the application software with the operating system and then transfer the entire software on to the memory chip. Once the software is transferred to the memory chip, the software will continue to run fora long time you do not need to reload new software. As shown in Fig. the building blocks are:

• Central Processing Unit (CPU)
• Memory (Read-only Memory and Random Access Memory)
• Input Devices
• Output devices
• Communication interfaces
• Application-specific circuitry

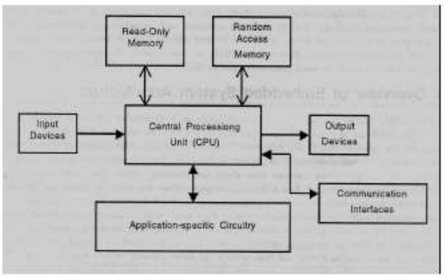

Figure 1: Blocks of hardware embedded system

• Central Processing Unit (CPU):

- o The Central Processing Unit (processor, in short) can be any of the following: microcontroller, microprocessor or Digital Signal Processor (DSP). A micro-controller is a low-cost processor. Its main attraction is that on the chip itself, there will be many other components such as memory, serial communication interface, analog-to digital converter etc. So, for small applications, a micro-controller is the best choice as the number of external components required will be very less. On the other hand, microprocessors are more powerful, but you need to use many external components with them. D5P is used mainly for applications in which signal processing is involved such as audio and video processing.

• Memory:

- o The memory is categorized as Random Access 11emory (RAM) and Read Only Memory (ROM). The contents of the RAM will be erased if power is switched off to the chip, whereas ROM retains the contents even if the power is switched off. So, the firmware is stored in the ROM. When power is switched on, the processor reads the ROM; the program is program is executed.

• Input devices:

- o Unlike the desktops, the input devices to an embedded system have very limited capability. There will be no keyboard or a mouse, and hence interacting with the embedded system is no easy task. Many embedded systems will have a small keypad-you press one key to give a specific command.

A keypad may be used to input only the digits. Many embedded systems used in process control do not have any input device for user interaction; they take inputs from sensors or transducers 1'fnd produce electrical signals that are in turn fed to other systems.

• Output devices:

- o The output devices of the embedded systems also have very limited capability. Some embedded systems will have a few Light Emitting Diodes (LEDs) to indicate the health status of the system modules, or for visual indication of alarms. A small Liquid Crystal Display (LCD) may also be used to display some important parameters.

• Communication interfaces:

- o The embedded systems may need to, interact with other embedded systems at they may have to transmit data to a desktop. To facilitate this, the embedded systems are provided with one or a few communication interfaces such as RS232, RS422, RS485, Universal Serial Bus (USB), IEEE 1394, Ethernet etc.

1.5 Block Diagram:

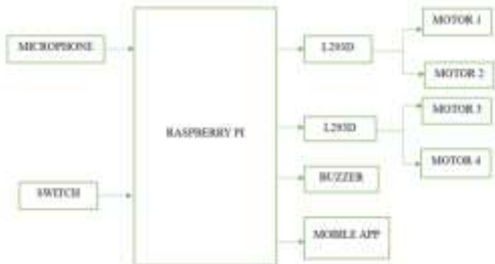

Figure 2: Block Diagram

• Microphone: The microphone is responsible for capturing the user's voice commands. It converts sound waves into electrical signals that can be processed by the system.

• Switch: The switch button is used to initiate the process.

• Buzzer: The buzzer produces a beep sound when the switch is pressed and turns on the microphone for the user to give the input.

• L293D IC: The L293D IC can be connected to the Raspberry Pi or microcontroller to receive control signals. These signals determine the speed and direction of the motors used in the dispenser system.

• Motors: The motors in the system are responsible for dispensing mechanisms. They are controlled by the Raspberry Pi based on the user's command and the predictions made by the machine learning model.

• Raspberry Pi: The Raspberry Pi serves as the central computing unit in the system. It runs the necessary software and algorithms, processes audio input from the microphone, controls the motors, and communicates with other components.

• Mobile App: The mobile app is used to display the current status of the motors whether it is in "RUNNING" state or "OFF" state.

1.6 Power Supply:

Figure 3: Power Supply

LITERATURE SURVEY

[1]. V. Jyothi;K. Hanuja;Peta Shirisha;R. Avinash; P. Akhil – "Implementation of Voice Based Hot-Cold Water Dispenser System Using Raspberry Pi 3" -This system is completely supported voice-based, and it employs a Raspberry Pi circuit. It also has an IR sensor, a voice app, a Bluetooth module, jars for holding water, pipes, and a motor. During this project, the voice app detects the person's speech and transmits the appropriate information to the Raspberry Pi 3, which determines whether the water requested by the person should be hot or cold.

[2]. Muhammad Azlan Alim;Samsul Setumin;Anis Diyana Rosli;Adi Izhar Che Ani – "Development of a Voice-controlled Intelligent Wheelchair System using Raspberry Pi" - a voice recognition-based intelligent wheelchair system for physically disabled people who unable to control the wheelchair by their upper and lower limbs. This development employs voice command to controls the movement of the wheelchair in different directions. The android device is used as microphone to be connected to the Google Assistant prior to data processing by the Raspberry Pi. The Raspberry Pi will then command the servo motors to act accordingly. This system offers automatic obstacle detection via the use of an infrared sensor which aids the user to apply momentary brake button upon the obstacle detection.
[3]. Pooja Singh;Pinki Nayak;Arpita Datta;Depanshu Sani;Garima Raghav;Rahul Tejpal – "Voice Control Device using Raspberry Pi" - a device based on implementation of a voice command system as an intelligent personal assistant. The services provided by the device depends on the input given in the form of voice command by the user and ability to access information from a variety of online sources such as weather, telling time or accessing online applications to listen to music. This Voice driven device uses Raspberry Pi as its main hardware. Speech to text engine is used to convert the voice command to simple text. Query processing is then applied using natural language processing (NLP) onto this text to interpret the intended meaning of the command given by the user. After interpreting the intended meaning, text to speech conversion is used to give appropriate output in the form of speech. [4]. Ratna Aisuwarya;Yulita Hidayati – "Implementation of Ziegler-Nichols PID Tuning Method on Stabilizing Temperature of Hot-water Dispenser" - The low-cost dispenser has disadvantages such as unable to maintain the water temperature to remain stable. To brew hot drinks such as coffee and tea require a specific range of temperature of 90 - 96 °C. Several previous studies regarding automatic dispensers have discussed the existing problems; only there are still some drawbacks when controlling the temperature stability in the dispenser. Further development is needed to overcome these shortcomings. For that purpose, we proposed a dispenser that can maintain the stability of hot water temperature. This dispenser will make it easier for users to brew coffee and tea with the ideal water temperature and produce a stable temperature that produces a good quality drink. The designed system uses water-resistant temperature sensor. Voltage control is applied to the heating element using the Ziegler-Nichols PID Tuning Method in order to control the temperature stability. Experimental results show that the system can maintain the temperature of hot water in the dispenser to keep it stable with a range from 92.31 °C to 92.62 °C, while the system without controller unable to maintain the stability of hot water temperature because the hot water temperature reaches a maximum temperature of 95.62 °C exceeding the set point of 92 °C.

RASPBERRY PI

3.1 Raspberry Pi Board

Figure 4: Raspberry Pi Board

A Raspberry Pi 3 board contains BCM2837 controller which supports ARM11 processing unit. This is the Broadcom chip used in the Raspberry Pi 3, and in later models of the Raspberry Pi. The underlying architecture of the BCM2837 is identical to the BCM2836. The only significant difference is the replacement of the ARMv7 quad core cluster with a quad-core ARM Cortex A53 (ARMv8) cluster. The ARM cores run at 1.2GHz, making the device about 50% faster than the Raspberry Pi The Video core IV runs at 400Mhz.

3.2 Power Supply

The input to the circuit is applied from the regulated power supply. The Ac input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating Dc voltage. So, in order to get a pure Dc voltage, the output voltage from the rectifier is fed to a filter to remove any Dc components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

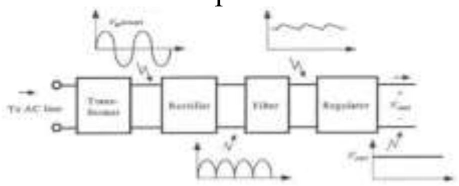

Figure 5: Block Diagram of Power Supply

3.3 Microphone:

Figure 6: Microphone

A microphone is a device that converts mechanical energy waves or sound into electrical energy waves. Speaking into a microphone excites (moves) a diaphragm that is coupled to a device that creates an electrical current proportional to the sound waves produced.

Microphones are a part of everyday life. They are used in telephones, transmitters for commercial radio and television broadcast, amateur radio, baby monitors, tape recorders, motion pictures, and public address systems. There are many different types of microphones the design depending upon the application. Sound recording, radio and television, and motion picture studios use ribbon or condenser type microphones because of their high-quality reproduction of sound. Public address systems, telephones, and two-way radio communications systems can use carbon, ceramic, or dynamic microphones because of their versatility and low cost.

Depending upon the type of microphone, raw materials may vary. Permanent magnets are generally made from a neodymium iron boron compound. The voice coil and cable are made from copper wire. Plastic is used for cable insulation. The case is usually made from aluminum sheet and sometimes plastic.

3.4 DC Motor

Figure 7: DC Motor

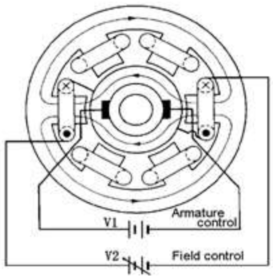

Figure 8: Cross-sectional View of DC Motor

Motor is a device that creates motion, not an engine; it usually refers to either an electrical motor or an internal combustion engine.

3.5 WIFI

A wireless network uses radio waves, just like cell phones, televisions and radios do. In fact, communication across a wireless network is a lot like two-way radio communication.

Here is what happens:

A computer's wireless adapter translates data into a radio signal and transmits it using an antenna.

A wireless router receives the signal and decodes it. The router sends the information to the Internet using a physical, wired Ethernet connection.

The process also works in reverse, with the router receiving information from the Internet, translating it into a radio signal and sending it to the computer's wireless adapter.

The radios used for Wi-Fi communication are very similar to the radios used for walkie-talkies, cell phones and other devices. They can transmit and receive radio waves, and they can convert 1s and 0s into radio waves and convert the radio waves back into 1s and 0s. But Wi-Fi radios have a few notable differences from other radios:

A small device known as a wireless transmitter, or hub, is required; this device receives information from the internet via your home broadband connection. This transmitter (often referred to as a Wireless Access Point, or WAP) then converts this information

Wi-Fi networks have no physical wired connection between sender and receiver by using radio frequency (RF) technology -- a frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.

3.6 Buzzer

Figure 9: Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or key stroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers, and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play."

3.7 Switch

Figure 10: Switch

A switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another. The most common type of switch is an electromechanical device consisting of one or more sets of movable electrical contacts connected to external circuits. When a pair of contacts is touching current can pass between them, while when the contacts are separated no current can flow.

Switches are made in many different configurations; they may have multiple sets of contacts controlled by the same knob or actuator, and the contacts may operate simultaneously, sequentially, or alternately. A switch may be operated manually, for example, a light switch or a keyboard button, or may function as a sensing element to sense the position of a machine part, liquid level, pressure, or temperature, such as a thermostat.

FLOWCHART

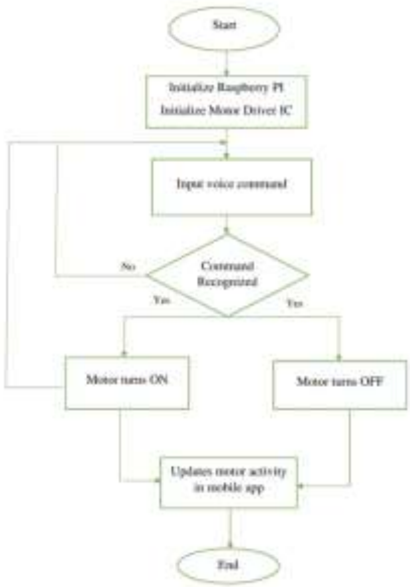

Figure 11: Flowchart

CIRCUIT AND RESULT

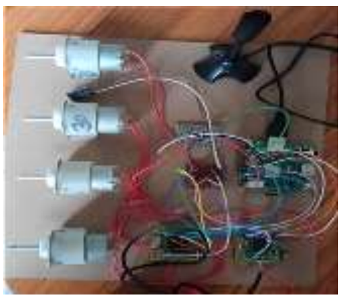

Figure 12: Project Kit

5.1 Working Module

This project, Speech-based multi dispenser system with AI and ML is developed using Raspberry Pi, a popular single-board computer that allows for easy integration of hardware components and programming in Python.

Here is an overview of how the system works:

• Audio input: The system takes audio input from a microphone connected to the Raspberry Pi. The user speaks a command to the system, such as “MOTOR 1 ON” And “MOTOR 1 OFF”.

• Speech recognition: The audio input is processed by a speech recognition algorithm, which converts the user's spoken words into text using natural language processing techniques. The text is then parsed to extract the relevant commands and parameters.

• Machine learning: The extracted commands and parameters are then fed into a machine learning algorithm that has been trained on a dataset of audio recordings and corresponding dispensing actions. The algorithm uses features such as voice frequency, pitch, and tone to predict the correct type and amount of to dispense based on the user's command.

• Dispensing: Once the machine learning algorithm has made its prediction, the Raspberry Pi turns on the motor.

• Feedback: The system provides feedback to the user by updating the information on the mobile app. Overall, the speech-based multi dispenser system with AI and ML and Raspberry Pi is an efficient and user-friendly way to dispense liquids using voice commands.

5.2 Result

Figure 13: MOTOR 1 RUNNING

When the user gives the command “MOTOR 1 ON” then the microphone captures the user's command, which is then processed by the Raspberry Pi. Upon recognizing the command, the Raspberry Pi generates a control signal that is sent to the L293D motor driver. The motor driver interprets the signal and activates the corresponding output pin connected to MOTOR 1. This activation provides the necessary power and control signals to the DC motor, resulting in the dispensing mechanism and when the user gives the command “MOTOR 1 OFF” then the motor driver deactivates and stops the supply of power and control signals to the DC motor, resulting in its cessation of operation and it is displayed in the mobile app as shown in figure.

Figure 14: MOTOR 2 RUNNING

Similarly, with when the user gives command such as "MOTOR 2 ON" and "MOTOR 2 OFF" the same operations are performed as mentioned above and it is displayed in the mobile app.

Figure 15: MOTOR 3 RUNNING

Similarly, with when the user gives command such as "MOTOR 3 ON" and "MOTOR 3 OFF" the same operations are performed as mentioned above and it is displayed in the mobile app.

Figure 16: MOTOR 4 RUNNING

Similarly, with when the user gives command such as "MOTOR 4 ON" and "MOTOR 4 OFF" the same operations are performed as mentioned above and it is displayed in the mobile app.

5.3 Advantages

• Hands-free operation: The system is completely voice-controlled, allowing for hands-free operation. This is particularly useful in settings where the user's hands may be occupied or dirty, such as in a kitchen or laboratory.

• User-friendly: The system is easy to use and does not require any specialized training or knowledge. Users can simply speak their desired commands and the system will take care of the rest.

• Precise dispensing: The use of AI and ML algorithms allows for more precise and accurate dispensing, reducing the risk of over-dispensing or under-dispensing.

• Efficient: The system can dispense quickly and efficiently, reducing the amount of time and effort required for manual dispensing. Overall, the speech-based multi dispenser system with AI and ML offers a convenient and efficient way to dispense liquids while reducing the risk of errors and improving user experience.

5.4 Disadvantages

• Dependency on voice recognition: In noisy or crowded environments, or for users with speech impediments, the accuracy of the system may be compromised.

• Maintenance: It requires frequent maintenance

• Cost: Although highly effective , the cost of building and maintaining the system may be higher than that of traditional dispensing systems.

5.5 Applications

The speech-based multi dispenser system with AI and ML has a variety of potential applications in different industries and settings, including:

• Pharmaceutical Industry: The system can be used in pharmacies or hospitals to dispense medication based on spoken instructions from patients or healthcare professionals. The AI and ML components can help ensure accurate dosage, detect potential drug interactions, and provide personalized medication recommendations.

• Retail and E-commerce: The system can be integrated into retail stores or e-commerce platforms to enable voice-controlled ordering and dispensing of products. Customers can place orders verbally, and the system can process the request, retrieve the items from inventory, and dispense them accordingly.

• Food and Beverage Industry: The system can be utilized in restaurants, cafeterias, or self-service stations for ordering and dispensing food and beverages. Customers can speak their order, and the system can prepare and dispense the requested items based on AI and ML algorithms that optimize inventory management and customer preferences.

• Automated Vending Machines: The system can be incorporated into vending machines to enhance the user experience. Users can use voice commands to select products, make customizations, and complete transactions. The system can leverage AI and ML to analyse customer preferences, optimize product offerings, and provide personalized recommendations.

• Healthcare and Home Care: The system can be deployed in healthcare facilities or homes to automate the dispensing of healthcare products or supplies. For example, it can dispense medical supplies, first aid kits, or personal care items based on user requests or pre-defined protocols.

• Industrial Settings: The system can be applied in manufacturing or warehouse environments for automated dispensing of components, tools, or materials. AI and ML algorithms can optimize inventory management, track usage patterns, and predict replenishment needs.

• Public Facilities: The system can be implemented in public facilities like airports, train stations, or libraries to provide self-service access to various items or services. For example, it can dispense tickets, travel passes, or library materials based on voice commands or user identification.

• Hospitality Industry: The system can be used in hotels or resorts to automate the delivery of amenities, toiletries, or other guest requests. Guests can request items through voice commands, and the system can dispatch the items to the designated locations.

• Automated Assistance: The system can serve as an automated assistant in various contexts, such as information kiosks, customer service centres, or reception areas. Users can ask questions or make requests, and the system can provide relevant information or dispense necessary resources.

CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

By implementing this project, the overall result will be successful. The motive of making the project cost efficient and user friendly is considered and achieved. The proposed system is created with the use of different sensors, Raspberry Pi as controller and microphone to get command from user. With the help of the Raspberry Pi, the voice recognition mode can be controlled and is sent to the sensor. The system has been programmed to have communication capability. Taking into consideration the target audience of elderly and handicapped people, the project developed is user friendly.

6.2 Future Scope

• Integration with smart home devices: Integrating the dispenser system with smart home devices can add a new level of convenience and ease of use for the users. For example, users can set up routines or schedules that automatically dispense liquids at specific times of the day or week. This integration can be done through voice commands, smartphone apps, or through other IoT devices.

• Advanced machine learning algorithms: The current machine learning algorithms used in the system can be further improved with the integration of more advanced techniques such as deep learning or reinforcement learning. This can enable the system to learn from user feedback and adapt to new dispensing patterns, improving its accuracy and reducing the potential for waste or errors.

• Cloud-based storage: Storing dispensing data in the cloud can enable users to access their dispensing history from anywhere, anytime. Additionally, the data can be used to generate insights and recommendations for users, such as identifying potential health risks based on dispensing patterns.

• Expansion to other industries: The system can be adapted and customized for use in other industries such as cosmetics, personal care, and automotive, where precise dispensing is important. This can open up new markets and opportunities for the system.

BIBLIOGRAPHY

Textbooks:

[1] Face Detection and Recognition Using OpenCV Mrs. Madhuram.M, B. Prithvi Kumar, Lakshman Sridhar, Nishanth Prem, Venkatesh Prasad International Research Journal of Engineering and Technology Volume 05-No.10,October 2018.

[2] Voice recognition by Google Home and Raspberry Pi for smart socket control Chen-Yen Peng ; RungChin Chen IEEE 2019.

[3] Voice processing with Internet of Things for a home automation system Juan Celis ; Rodrillo Llanos ; Sergio Castro ; Sergio Sepúlveda ; Byron Medina ; Dinael Guevara ; Luis Cam IEEE 2019.

[4] Wireless voice-controlled multi-functional secure ehome B. Vamshi ; V. K. Mittal ; K. V. Sai Vineeth IEEE 2018.

[5] Home automation using raspberry Pi through Siri enabled mobile devices Ana Marie. D Celebre ; Alec Zandrae D. Dubouzet ; Ian Benedict A. Medina ; Adrian Neil M. Surposa IEEE 2018.

[6] Sonali Sen, Shamik Chakrabarty, Raghav Toshniwal, Ankita Bhaumik, "Design of an Intelligent Voice Controlled Home Automation System," Department of Computer Science St. Xavier's College, Kolkata international Journal of Computer Applications (0975 – 8887) Volume 121 – No.15, July 2015.

[7] Saptarshi Bhowmik1, Sudipa Biswas2, Karan Vishwakarma3, Subhankar Chattoraj4*, Parami Roy5, "Home Automation System Using Android Application," Department of Computer Science Jadavpur University IBM India Research Associate ESL Technologies Research Associate ESL Technologies TCS, India. International Journal of Scientific and Research Publications, Volume 6, Issue 12, December2016.

[8] Anurag Pandey1, Umesh Mishra2, Akash Chaubey3,"Voice Controlled Home Automation" BE CMPN, Department of Computer Engineering, Shree L.R. Tiwari College of Engineering, Mira Road (E), Thane, Maharashtra, India . International Journal of Research in Science & Engineering Special Issue 7-ICEMTE March 2017.

[9] Face and Speech Recognition Based Smart Home Alina Munir ; S. Kashif Ehsan ; S. M. Mohsin Raza ; Mumajjed Mudassir IEEE 2019.

[10] Advanced Computational Intelligence: An International Journal (ACII), Vol.3, No.3, July 2016 DOI:10.5121 "Voice Command System Using Raspberry PI" Surinder Kaur1, Sanchit Sharma2, Utkarsh Jain3 and Arpit Raj Bharati Vidyapeeth's College of Engineering, New Delhi, India.
[11] International Journal on Emerging Technologies (Special Issue NCETST-2017) 8(1): 88-91(2017) (Published by Research Trend, Website: www.researchtrend. ISSN No. (Print): 0975-8364 ISSN No. (Online): 2249-3255 Study of Automatic Water Dispenser Abhishek Srivastava1, Shubham Dwivedi1, Saurabh Bhardwaj1 and Mr. Hem Chandra.
[12] Abhishek Srivastava, Shubham Dwivedi, Saurabh Bhardwaj, Mr. Hem Chandra Joshi," Study of Automatic Water Dispenser", International Journal on Emerging Technologies (Special Issue NCETST-2017) 8(1): 88- 91(2017).