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Azima 3.0

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1. Abstract

Azima 3.0 is a revolutionary robotic system for changing the face of advertising, communication, and automation in highly visited public spaces. With improved robotics and artificial intelligence, there has been high demand for intelligent interactive systems Azima 3.0 meets this need by merging high-definition display technology, face recognition, and remote control into a very interactive and dynamic enterprise and organizational platform.

One of the standout features of Azima 3.0 is its 10.5-inch touchscreen screen, which can be operated remotely through a smartphone or computer. This functionality allows for real-time content updating, and as such, it is an effective advertising, event promotion, and public information delivery tool. The robot also has a face recognition sensor and high-definition camera, making it useful for meeting attendance tracking, security surveillance, and interactive customer interaction. The platform combines several state-of-the-art technologies, such as Raspberry Pi 3 Model B, Arduino, ESP8266 WiFi module, LED matrix displays, and motor driver modules. They provide smooth movement, real-time content management, and improved user interaction. Intended for mounting in airports, malls, exhibitions, metro stations, and other crowded areas, Azima 3.0 offers businesses a cost-effective and interactive alternative to conventional static advertising methods.

Apart from business applications, the robot also holds promise for use in schools, business environments, and public service. It can be employed to assist with automated registrations, confirmation of attendance, and tailored customer service. It can be used to help with automated registrations, attendance confirmation, and customized customer service. However, issues such as power consumption, visibility of the display, and integration with software need to be resolved in order to provide maximum performance. Azima 3.0 is a move towards the future of smart robotic systems, illustrating how automation and digital marketing can be merged into one cohesive package to drive public interaction and productivity.

Keywords: Face recognition, Remote control capabilities, Advertising, Multiple cutting-edge technologies.

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1. Introduction

The evolution of robotics and artificial intelligence has given rise to innovative solutions for numerous industries, such as advertising, security, and attendance management. Azima 3.0 is a cutting-edge robotic system aimed at increasing productivity and efficiency in public and corporate environments. Fitted with a high-resolution LCD screen, face recognition technology, and mobile connectivity, this robotic system has several functions, the main one being digital advertising and automated attendance tracking. By incorporating the latest technology, Azima 3.0 offers an affordable and effective substitute for conventional advertisement techniques while guaranteeing a attendance management process.

Azima 3.0 has one of its main uses in the advertising industry. Companies usually find it difficult to grab the attention of their target market in busy locations like shopping malls, airports, and trade shows. Conventional advertisement mediums, like posters and billboards, are non-interactive and static. In comparison, Azima 3.0 provides an interactive solution with the ability for companies to present promotional content on a mobile platform.

The robot's high-definition LCD screen offers improved visibility, and its mobility allows it to move to various locations to increase audience interaction. The robot is also remotely controlled through a mobile app, where companies can dynamically update advertisements depending on the audience demographics and preferred locations..Azima 3.0 is designed with a blend of sophisticated hardware and software elements. The Raspberry Pi 3 Model B is used as the main processing unit to process data input and output, while an ESP8266 module provides smooth wireless communication.

In general, Azima 3.0 is a major advancement in robotic automation. By integrating advertising, face recognition, and remote management features into one platform, it provides a multi-purpose solution for companies and organizations. As technology continues to advance, further advancements in AI and machine learning may widen the possibilities of Azima 3.0, making it an unavoidable asset in industries.

2. Objectives

The main goal of the Azima 3.0 project is to create a multifunctional robotic system that optimizes digital advertising and attendance management using face recognition technology. The robot is intended to offer companies and institutions a new platform for dynamically presenting advertisements in densely populated public areas like shopping malls, airports, and subways. With the incorporation of a high-resolution LCD screen and remotely controlled content management system, the robot enables advertisers to refresh and personalize their advertisement content according to audience response and location-based demands.Another critical goal is enhanced attendance management using an automated facial recognition system.

The Azima 3.0 robot features a sophisticated camera and recognition system to identify persons accurately, hence a valuable application in corporate board meetings, conferences, and learning institutions. This system does not require manual registration of attendance, which saves time and administrative tasks and provides greater accuracy in tracking participants. Furthermore, the project seeks to optimize real-time user interaction and communication with the robotic system. With mobile app integration, users can remotely control the functions of the robot, program advertisements, and track attendance information. The presence of wireless connectivity through ESP8266 provides hassle-free data transfer, allowing for real-time updates and remote system control.A strong emphasis is put on user convenience and security. The robot has an alarm feature with a buzzer and LED matrix display for alerting users to attempts at unauthorized access, providing a security aspect to its functionality.

3. Block Diagram

The block diagram is a robotic system based on the Raspberry Pi 3 Model B, combining several components to facilitate automation, identification, and manual control. The system is driven by a 12V input, which powers the Raspberry Pi and other attached components. It manages a robot's entire body functionality, enabling movements to be performed either manually or through commands from an app. Besides that, the system also comes with a Logitech C920 HD Pro Webcam, which is presumably utilized for user identification and registration. Upon completion of identification, the system can then show corresponding information on a screen. The feature of being able to play advertisements is a significant aspect of the system and implies possible use in commercial settings or interactive kiosks. The Raspberry Pi serves as the processing brain of the system, controlling all interactions between the robot, webcam, monitor, and control inputs. The configuration makes the system adaptable for use in service robotics, automated help, or interactive display terminals.

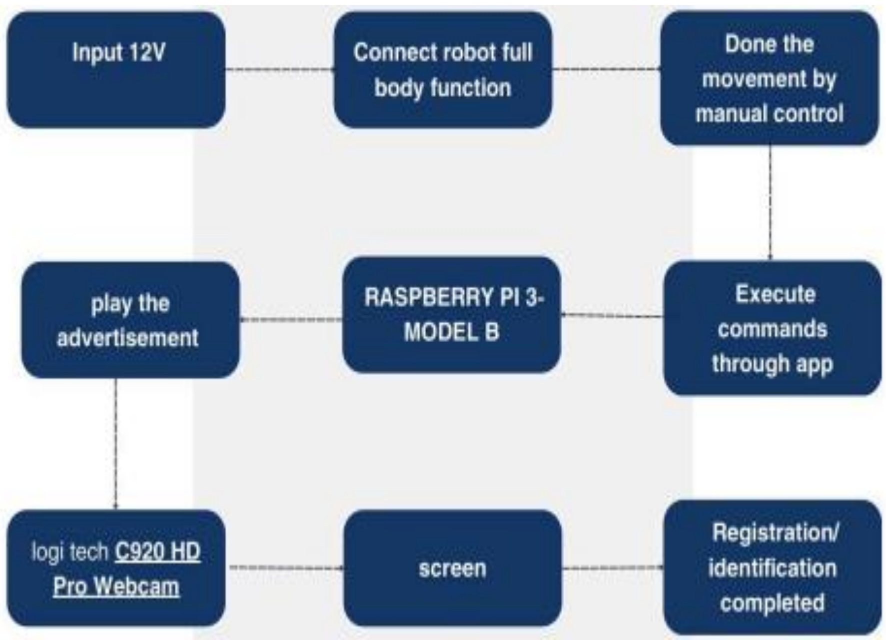

Figure 1: Block Diagram

4. Components Used

Raspberry Pi 3 Model B –The Raspberry Pi 3 Model B is a tiny, single-board computer boasting a 1.2 GHz quad-core ARM Cortex-A53 processor, 1GB RAM, and onboard Wi-Fi and Bluetooth capabilities. It features USB ports, an HDMI output, GPIO pins, and the ability to run Raspbian or other Linux-based OS, making it ideal for robotics, IoT, and embedded systems. The board is widely utilized for DIY, automation, and educational activities due to it being inexpensive and versatile.

Arduino ATmega2560 – The Arduino ATmega2560 is a microcontroller board with the ATmega2560 chip at its core, featuring 54 digital I/O pins, 16 analog inputs, 4 UARTs, and 16 MHz of clock speed. It is well known for robotics, automation, and IoT development due to having enormous memory and over one communication interface. It is perfect for applications where multiple sensor inputs are needed, motor control, and real-time processing are involved.

ESP8266 WiFi Module – ESP8266 WiFi Module is a low-power and low-cost Wi-Fi microchip that contains TCP/IP networking properties integrated within it, enabling microcontrollers to provide access to wireless networks. It has a 32-bit

Tensilica processor, GPIO pins, and AT commands, making the product suitable for application in IoT as well as wireless data transmission. The module has wide application in home automation, smart devices, and cloud projects due to its cost-effectiveness and ease of integration.

10.5-inch LCD Touchscreen – A 10.5-inch LCD Touchscreen is a high-definition display with touch sensitivity, allowing interactive control for different applications. It mostly has capacitive or resistive touch technology, so users can interact, choose, and navigate digital content. It is used in embedded systems, tablets, kiosks, and Raspberry Pi projects for display and user interaction purposes.

LED Matrix Display (8×8) – An LED Matrix Display (8×8) contains 64 LEDs in a structure of an 8-column by 8-row grid to show text, symbols, and animation. A microcontroller or a driver IC (such as MAX7219) is used to control it for individual illumination of LEDs.This display is widely used in digital signage, scoreboards, and interactive electronic projects for visual feedback and simple graphics.

16×2 Alphanumeric LCD–16×2 Alphanumeric LCD is an alphanumeric display module that is capable of displaying 16 characters of text on one line of 2 rows, typically employed for text output in embedded systems. It works based on a Hitachi HD44780 or similar controller, communicating with microcontrollers through 4-bit or 8-bit parallel communication. It's extensively used in DIY electronics, automation, and industrial uses for the purpose of displaying sensor readings, messages, and system status.

C920 HD Pro Webcam –The Logitech C920 HD Pro Webcam is an HD webcam which can capture video at 1080p 30fps as well as snap high definition photographs using its Carl Zeiss lens and auto-focus. It also has two microphones which supply clear sound, and the webcam supports USB too, best adapted for streaming, video calls, and computer vision development. This webcam is utilized commonly for face recognition, distant surveillance, and artificial intelligence projects because of its quality imaging and low-light vision.

L298N Motor Driver Module –L298N Motor Driver Module is a dual H-Bridge motor driver module capable of allowing a microcontroller to control two DC motors or a single stepper motor with different speed and direction control. It uses 5V logic level input and can have the capability for 5V to 35V motor voltage operation with the support of up to 2A per channel of current capability. The module finds broad applications in robotics, automation, and motor control systems for driving motors effectively.

12V 7.2Ah Battery –It is a rechargeable sealed lead-acid (SLA) or lithium-ion battery with a stable 12V output and 7.2 amp-hours (Ah) of capacity. It is widely used in UPS, robotics, electric cars, and backup power devices because of its durability and longevity. The battery is capable of powering microcontrollers, motors, and other electronics to provide a stable operation for many projects.

5. Working

The Azima 3.0 robot system is intended to be used as an interactive advertising and attendance management system, utilizing cutting-edge technologies such as face recognition, mobile connectivity, and display integration. The brain of the robot is based on a Raspberry Pi 3 Model B, which serves as the central processing unit, controlling various hardware components and running programmed instructions.The robot works through various functionalities. For advertising, it has a high-definition LCD display capable of displaying digital content like advertisements, announcements, and promotional materials. The digital content is controllable and updatable remotely through a mobile app so that users are able to control the display dynamically according to place or target group.For meeting attendance, the system uses a face recognition sensor and a high-definition webcam to recognize people and record their attendance. ESP8266 module facilitates smooth wireless communication that allows for real-time attendance record updates.

The Arduino microcontroller coordinates peripheral activities such as displaying on the screen, handling sensor inputs, and movement control if mobility is incorporated in future designs. A 12V lead-acid battery powers the supply system, providing adequate power to maintain the operation of all electronic devices. The system further has a buzzer and LED matrix display to mark authorized or unauthorized access, with an added security feature to its functionality. Regardless of its unique features, the issues of power consumption, weight control, and software optimization have to be considered for greater efficiency. Nonetheless, the Azima 3.0 robot presents a potential solution for businesses and institutions in search of an automated, low-cost advertising and attendance system. Future advancements can include AI-based analytics, voice recognition, and enhanced battery management to further improve its performance and usability in different industries.

6. Simulation

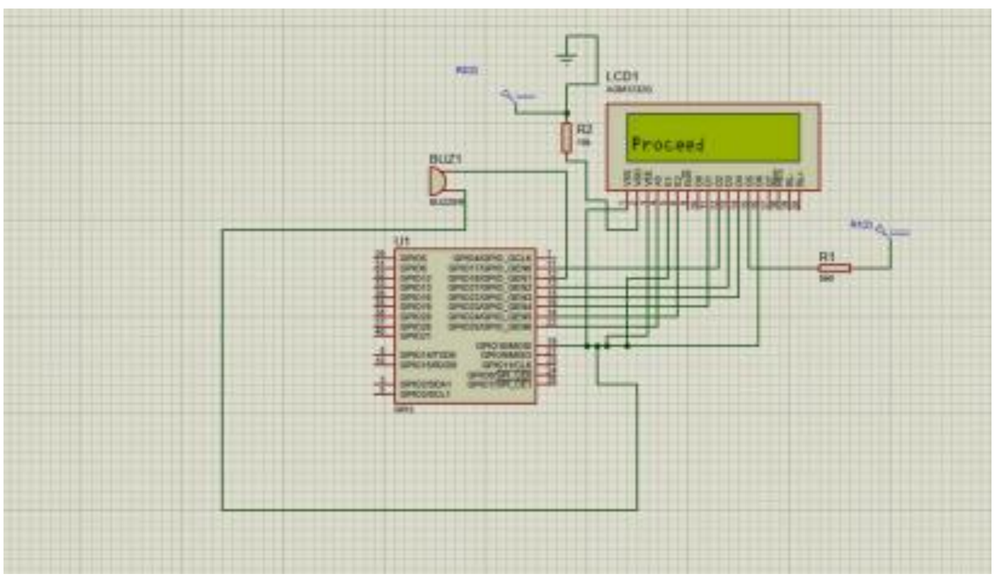

Figure 2: Simulation Diagram

This simulation diagram illustrates a Raspberry Pi 3 (RPi3) interfacing with a 16×2 LCD display and a buzzer. The LCD (AGM1232G) is connected via GPIO pins for data communication, while a 10kΩ potentiometer adjusts contrast. A 560Ω resistor with an LED serves as an indicator. The buzzer is controlled via GPIO for alert signaling.

7. Output

Face recognition outputs usually incorporate major metrics like detection accuracy, confidence score, and identification success rate. The process involves the capture of an image, facial feature extraction, and comparison with a stored database. A confident high score (e.g., 90% or higher) demonstrates a high match, whereas less confident scores reflect uncertainty. False positives and false negatives can arise from lighting, pose, or image conditions. Successful recognition initiates actions such as authentication, access control, or logging, whereas failure can initiate reattempts or alerts.

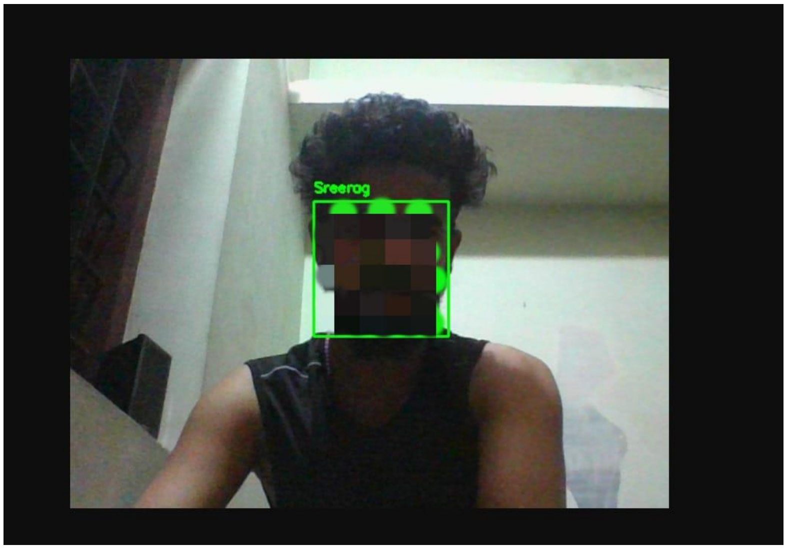

Figure 3: Face recognition out put

The advertisement output refers to the display or playback of promotional content through a screen or speaker. This can include videos, images, or text-based ads shown on digital screens, kiosks, or embedded systems. In interactive systems, advertisements may be triggered based on user activity, facial recognition, or predefined schedules. The output aims to engage viewers, promote products, or deliver information effectively. Factors like resolution, brightness, and audio clarity impact its effectiveness in attracting and retaining audience attention.

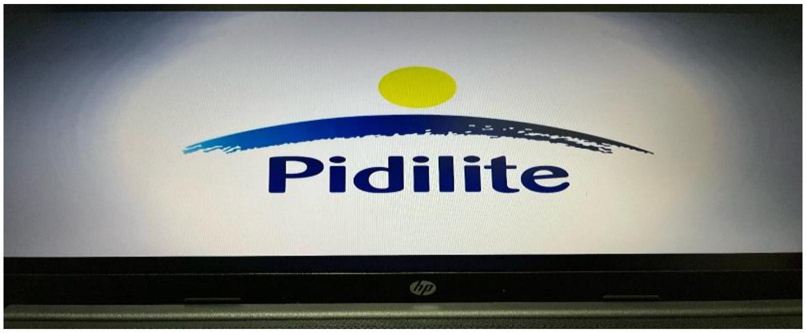

Figure 4: Advertisements out put

8. Circuit Diagram

This circuit diagram showcases an ESP32-based motor control system powered by a 12V lead-acid battery. The ESP32 microcontroller controls two gear motors via BTS7960 motor driver modules, which regulate motor speed and direction using PWM signals (LPWM, RPWM). A DF Mini Audio Player is integrated for sound output, connected to a speaker for audio feedback. A DC-DC buck converter steps down voltage to provide a stable 5V supply for low-power components. The system is designed for applications requiring motorized movement and audio feedback, making it suitable for robotics, automation, or interactive devices.

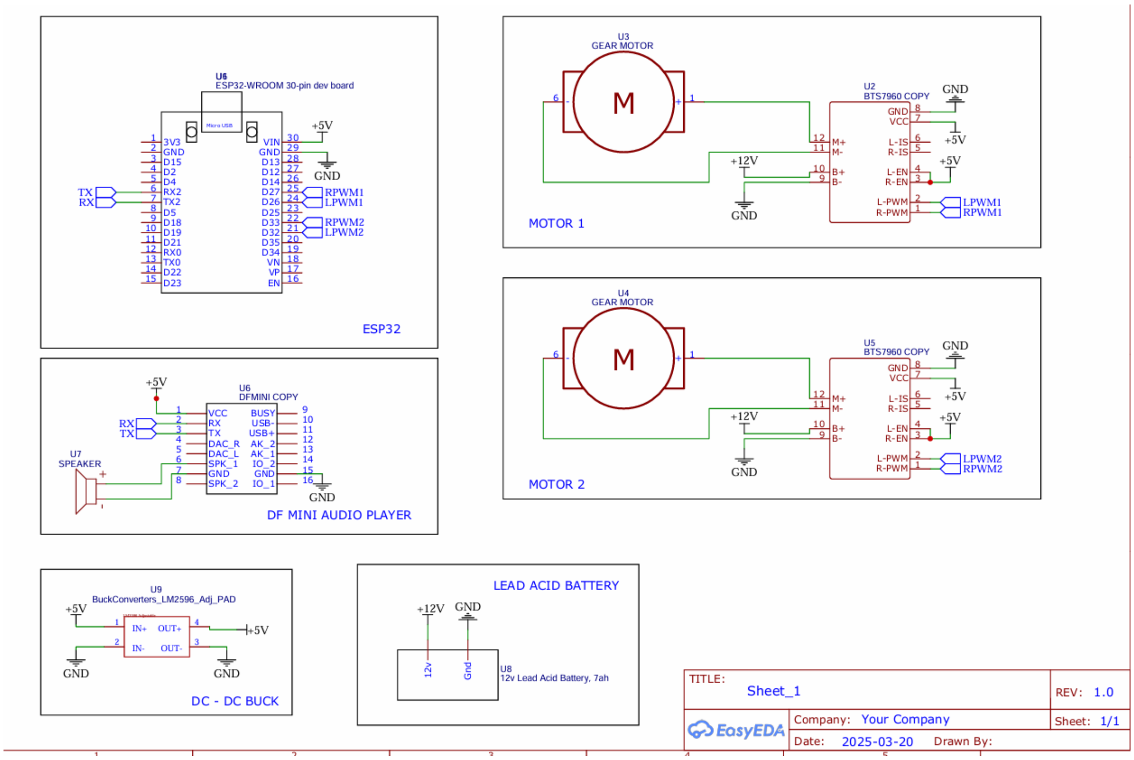

Figure 5: Circuit Diagram

9. Conclusion

The Azima 3.0 project is a new robotic system meant for advertising and meeting attendance using facial recognition technology. With the inclusion of a high-resolution touch screen, remote mobile app control, and facial recognition sensors, this robot increases participation in public areas like malls, airports, and metro stations. The system allows for dynamic content management and location-based advertising, presenting businesses with a potent marketing tool.

The robot's face-scanning capability for attendance taking still boosts its utilization for corporate and educational setups. Developed with the aid of Raspberry Pi, Arduino, and ESP8266, it processes data in an efficient manner while keeping communication lines open with peripheral devices. Some issues, including power demand, screen size, and software development, must nonetheless be resolved to ensure proper functionality.

Although with slight limitations, Azima 3.0 is an affordable and engaging substitute for conventional advertising. Its versatility in various applications, such as event promotion and public information release, makes it a worthwhile innovation in the automated display solution sector. Future development can be aimed at enhancing energy efficiency and its AI-based features to make it more effective in diverse industries.

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