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Voice Command Door Lock System

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Abstract- This project presents the design and implementation of a Voice-Activated Door Lock System integrated into a portable door unit constructed from glass fiber-reinforced polymer (GFRP), including a matching lintel beam. The primary objective is to enhance security, accessibility, and portability while maintaining structural durability and aesthetic appeal. The voice-controlled locking mechanism utilizes speech recognition technology to grant or deny access based on authorized voice commands. This hands- free approach to security offers a modern alternative to traditional key-based or keypad systems, ideal for users with mobility impairments or for smart home integration.

The door and lintel beam are fabricated using glass fiber, chosen for its lightweight nature, high strength- to-weight ratio, corrosion resistance, and ease of transportation, making the system suitable for both temporary installations and permanent structures. The portability of the door unit allows flexible deployment in residential, commercial, or construction site environments. The system is powered by a microcontroller (e.g., Arduino) interfaced with a microphone module, voice recognition module, and electronic lock. Security is further enhanced through multi-level authentication protocols and real-time status feedback via a mobile app or local display. This project merges advanced materials with intelligent control systems, providing a robust, user-friendly, and portable access control solution for modern smart environments.

Keywords: Voice-Activated Lock, Smart Door System, Glass Fiber-Reinforced Polymer (GFRP), Portable Door Unit, Speech Recognition.

I. INTRODUCTION

- **Emerging Need for Smart Security:** With the rise of smart technology, traditional lock-and-key systems are becoming outdated. There is a growing demand for intelligent, convenient, and secure alternatives to enhance everyday safety.
- **Concept of Voice-Activated Locking:** Voice recognition technology enables hands-free, user- friendly operation of security systems. A voice-activated door lock system provides secure access by identifying and authenticating vocal commands, eliminating the need for keys or manual entry.
- **Innovative Use of Glass Fiber Materials:** The door and its supporting lintel beam are constructed using glass fiber-reinforced polymer (GFRP). This material is chosen for its high strength-to- weight ratio, corrosion resistance, and portability, making the system ideal for mobile or modular installations.
- **Integration of Portability and Durability:** The system is designed to be portable, meaning it can be deployed in various temporary or permanent locations such as construction sites, smart homes, or temporary event structures. The glass fiber components ensure durability while keeping the unit lightweight.

- **Smart and Secure Design:** The voice lock system is powered by a microcontroller and linked with a voice recognition module and electronic locking mechanism. Only authorized users can gain access, making the setup both smart and secure.
- **Project Goal:** The aim of this project is to develop a prototype that demonstrates how modern speech recognition technology can be combined with advanced materials to build a secure, portable, and user-friendly door locking system.

II. ESTIMATIONS

- **VOICE DOOR LOCK COMMAND MODEL**

Cost Analysis :-

The estimated cost of our project is given below (Approximately)

Components	Quantity	Price (BDT)
Arduino Uno	1	110
Car door lock	1	448
Jumper wire	1	165
Latch lock	1	169
Motor driver L298n	1	229
Voice recognition module v3	1	1,950
Acrylic glass sheet	1	187
Acrylic double-sided sheet	1	309
	Total (Approximately) =	3,567

- **LINTEL BEAM**

Mix Proportion :-

The estimated mix design of our project is given below

COARSE AGGREGATE	3.08
FIBER GLASS	0.05
CEMENT	1
SAND	1.71
WATER	0.42

III. HEADINGS

- **Microcontroller (e.g., Arduino, Raspberry Pi):** Acts as the brain of the system, processing inputs from the voice module and controlling the elec- tronic lock based on programmed logic.
- **Voice Recognition Module:** This module captures and interprets voice commands. It compares the input with stored voice pat- terns to identify authorized users. Common modules include the Elechouse Voice Recognition Mod- ule or software-based recognition through Raspberry Pi.
- **Microphone:** Captures the user's voice input. It should be sensitive and noise-resistant to ensure accurate recogni- tion even in noisy environments.
- **Electronic Lock (Solenoid Lock / Magnetic Lock):** This is the actual locking mechanism. When the correct voice command is given, the microcontroller triggers the lock to open or close.
- **Power Supply Unit (Battery or Adapter):** Provides the necessary power to all components. For portable setups, a rechargeable battery pack may be used.
- **Glass Fiber Door with Lintel Beam:** The physical structure of the door system. Made from glass fiber-reinforced polymer (GFRP) for lightweight, strength, and corrosion resistance. The lintel beam supports the door structure and con- tributes to its portability and ease of installation.
- **Feedback System (Optional - LEDs, Display, or App):** Indicates system status such as locked/unlocked state, voice recognition success/failure, or battery level.
- **Enclosure and Mounting Hardware:** Houses and protects the electronic components. Ensures that the system is securely mounted to the door frame.
- **Fiber Glass:** Fiberglass concrete is a composite material made by adding fiberglass (glass fibers) to

concrete to improve its structural performance. The inclusion of fiberglass enhances the concrete's tensile strength, impact resistance, and durability.

- **Fiber Glass Concrete:**
  Fiberglass concrete, often referred to as Glass Fiber Reinforced Concrete (GFRC), is a composite material that combines the strength and durability of concrete with the lightweight and flexible properties of fiberglass.
- **Toughened Glass:**
  It also known as tempered glass, is a type of safety glass that is strengthened through a special thermal treatment process. The process involves heating the glass to a high temperature and then rapidly cooling it, which increases its strength and makes it more resistant to breaking under stress.

IV. SOME COMMON MISTAKES

Improper Mixing of Materials:
Issue: Fiberglass concrete requires a precise balance of ingredients, including concrete, fiberglass, and additives. Incorrect mixing can result in poor bonding between the fiberglass and concrete, leading to weakened structures.
Solution: Follow the manufacturer's instructions carefully for the correct ratios of materials. Ensure thorough mixing to achieve a homogeneous blend.

- **Not Using the Right Type of Fiberglass:**

Issue: Different types of fiberglass, such as chopped strand mat or woven roving, have different properties. Using the wrong type for the intended application can result in insufficient reinforcement or structural integrity.
Solution: Select the appropriate fiberglass reinforcement based on the strength and application requirements. Consult with a professional or refer to design guidelines to choose the correct material.

- **Inadequate Curing:**

Issue: If GFRC is not properly cured, the concrete may not reach its full strength, and the fiberglass may not bond well with the concrete, leading to cracks or premature failure.
Solution: Allow for proper curing time, ensuring the mixture stays moist and maintains the right temperature during the curing process. This helps the concrete achieve maximum strength and durability.

V. CONFLICT OF INTEREST

In the context of the research on the voice door lock command system, it is important to clarify whether the involvement of civil engineering students may have influenced the results. If the research was conducted by students or involved their input, it's crucial to assess if their academic background, personal experiences, or any biases related to their field of study may have affected the outcomes.
However, if there were no conflicts of interest or undue influence by any individuals, groups, or organizations, including the civil engineering students, then the research findings should remain objective and unbiased. In such cases, it would be safe to state that the results of the research were not affected by the involvement of students, and the findings were based solely on the technical aspects and scientific methodology used in the study.

VI. CONCLUSION

Add: Conclusion

- **Acknowledgement**

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