Faculty of Computer Applications & Information Technology

BCA PROGRAMME

Semester III Project

Report for

240301306 Introduction to Embedded Systems Project

Definition

" Automated Dispenser For Harmful Chemicals"

Submitted by:

Group No. : 22

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PROJECT TITLE

Project Title – AUTOMATED DISPENSER FOR HARMFUL CHEMICALS

GROUP MEMBERS

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ABSTRACT

• This project presents an automated, touchless dispenser system designed for harmful chemicals and laboratory liquids, focusing on safety, hygiene, and complete removal of human contact. The system is built using Arduino Uno, Ultrasonic Sensor, Relay Module, Air Pump, 16x2 LCD Display, and a DFPlayer Mini MP3 module for voice guidance.

• When an object such as a beaker or container is detected by the ultrasonic sensor, the Arduino activates the relay-controlled air pump to dispense a fixed quantity of chemical. During this process, the LCD displays real-time messages such as “DISPENSING…”, while the DFPlayer Mini plays audio instructions like “Please wait, the liquid is being dispensed.” This enhances safety and improves user awareness.

• After dispensing, the system returns to standby mode, ready for the next object. The combination of contactless sensing, voice feedback, and clear LCD instructions ensures safe and efficient handling of hazardous liquids, reducing accidents, contamination, and unnecessary chemical exposure.

OBJECTIVE

- To design a touchless and automated harmful chemical dispenser.
- To eliminate direct human contact with unsafe liquids, improving safety.
- To integrate DFPlayer Mini to provide voice alerts and warning messages.
- To offer real-time LCD display instructions such as project name, detection, and dispensing status.
- To create a low-cost, safe, and scalable solution for laboratories, industries, and chemical-handling environments.

COMPONENTS

1. Hardware Components:
   - Arduino Uno
   - Ultrasonic Sensor (HC-SR04)
   - Relay Module (HC-05)
   - Air Pump
   - DFPlayer Mini mp3 Module
   - Speaker (8Ω)
   - LCD (16x2)
   - Battery/Power Supply
   - Liquid Container, Tubes, and Nozzles

2. Software Components:
   - Arduino IDE
   - Embedded C code
   - DFPlayer Mini Library
   - LiquidCrystal_I2C Library

COMPONENTS FUNCTIONALITY

1. **Hardware Components Functionality:**
   - Ultrasonic Sensor: Detects the presence of a hand or container by measuring distance.
   - Arduino Uno: Brain of the system; processes sensor data, controls the relay, updates LCD, and plays audio via DFPlayer.
   - Relay Module: Works as an electronic switch that turns the air pump ON/OFF.
   - Air Pump: Dispenses the chemical safely through the nozzle.
   - LCD Display (16x2): Shows user messages like *"Place Object"*, *"Dispensing…"*, *"Ready"*.
   - DFPlayer Mini: Plays pre-recorded audio warnings and guidance for user safety.
   - Speaker: Outputs sound instructions from DFPlayer Mini.

2. **Software Components Functionality:**
   - Arduino IDE: Code development and uploading.
   - Embedded C/C++: Logic for sensing, control, and display.

WORKING OF SYSTEM

- The ultrasonic sensor continuously monitors for an object within a predefined distance.
- When a hand or container is detected, the Arduino triggers the relay.
- The relay activates the air pump, dispensing the chemical automatically.
- During dispensing, the LCD displays "DISPENSING…" and DFPlayer Mini plays an alert like : "Please wait, chemical is being dispensed."
- After the fixed time, the air pump turns OFF automatically.

- The LCD shows “READY FOR NEXT USE”, and the DFPlayer may play a message such as “Process completed safely.”
- The system resets and waits for the next object.

FUNCTIONALITY OF SYSTEM

- Complete touchless detection and dispensing
- Voice alerts through DFPlayer Mini + speaker
- Clear LCD instructions for user assistance
- Reduces human exposure to hazardous chemicals
- Adjustable dispensing duration and sensor range
- Portable and battery-powered
- Cost-effective, safe, and reliable for laboratories, industries, and sanitation areas