Anti - Spoof Fingerprint Device and Water Quality Estimator

Riddhima Vijayvargiya (220883)

Department of Electrical Engineering, Indian Institute of Technology Kanpur

Prof. Tushar Sandhan, Dept. of Electrical Engineering

Introduction

Fingerprint recognition technology, widely used for its rellability, faces a significant challenge: spoofing attacks using fake fingerprints. To enhance security, liveness detection is employed, venfying if a fingerprint is real by using additional information beyond the fingerprint image. This project implements a machine learning model on a Raspberry Pi to detect spoofing attempts, utlizing advanced techniques like Ten Crop patch and crap processing to differentiate between real and fake fingerprints.

Methodology

1. Setup
Tested Rpi model using VNC viewer and managed remotely via PuTTY command line operation . Configured GPIO pins for hardware components.

2. Sensor Integration
Integrated R307 fingerprint sensor with RPi and ML model using essential libraries like Adafruit and PySerial.

3. Image acquisition
Captured high-quality images for ML model training and focussed on the fingerprint enrollment process.

4. Model training
Deployed initial recognition code on RPi, refining performance and resolving corruption.

5. Final deployment and testing
Successfully deployed the final model on Raspberry Pi and tested it against a variety of spoofed and original fingerprint datasets.

Objective

Integrate a pre-trained ResNet18 model for liveness detection into a Raspberry Pi 4B with fingerprint management and anti-spoofing components. Implement an advanced spoof detection algorithm and thoroughly test the system for secure biometric authentication across various sectors.

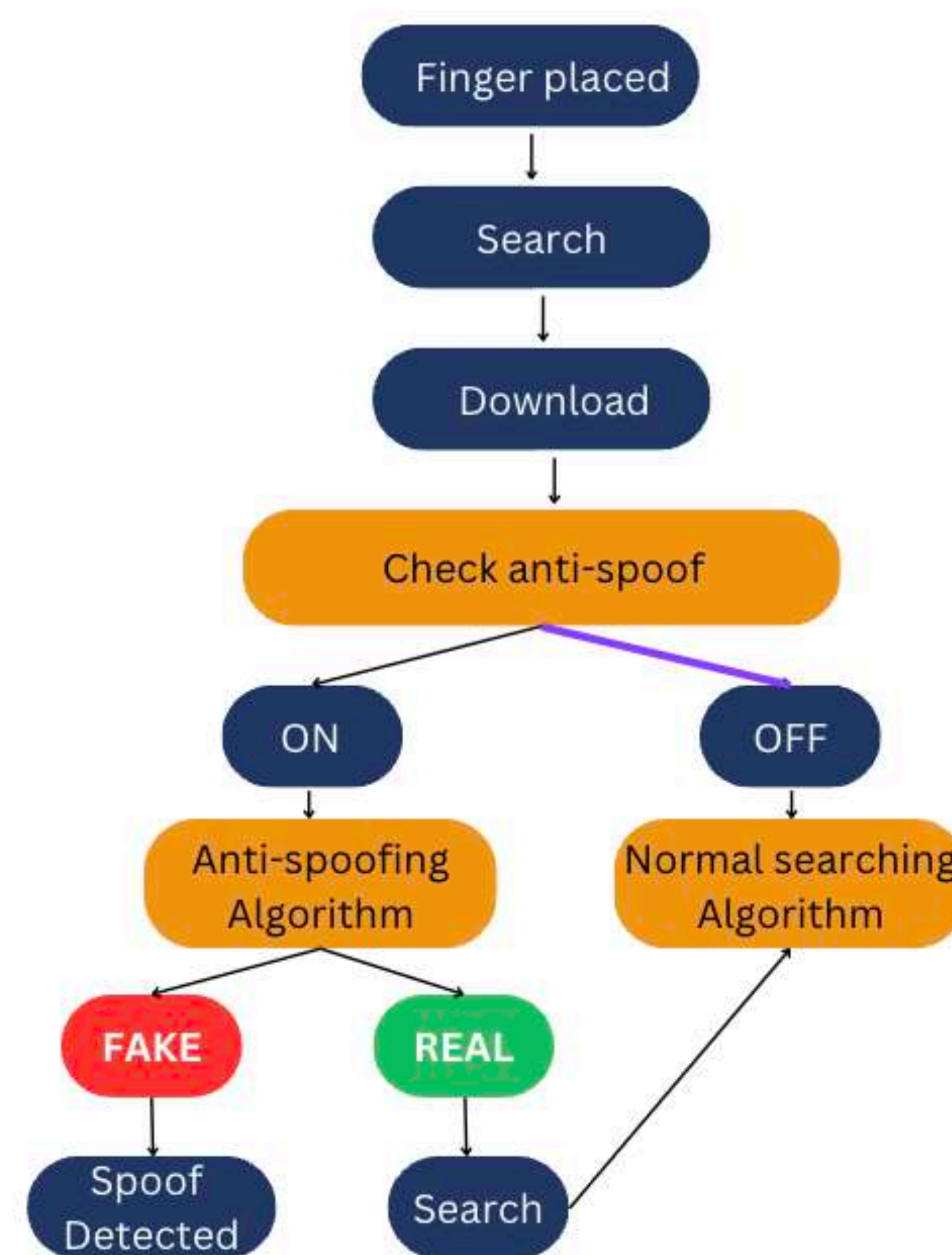## Circuit diagram
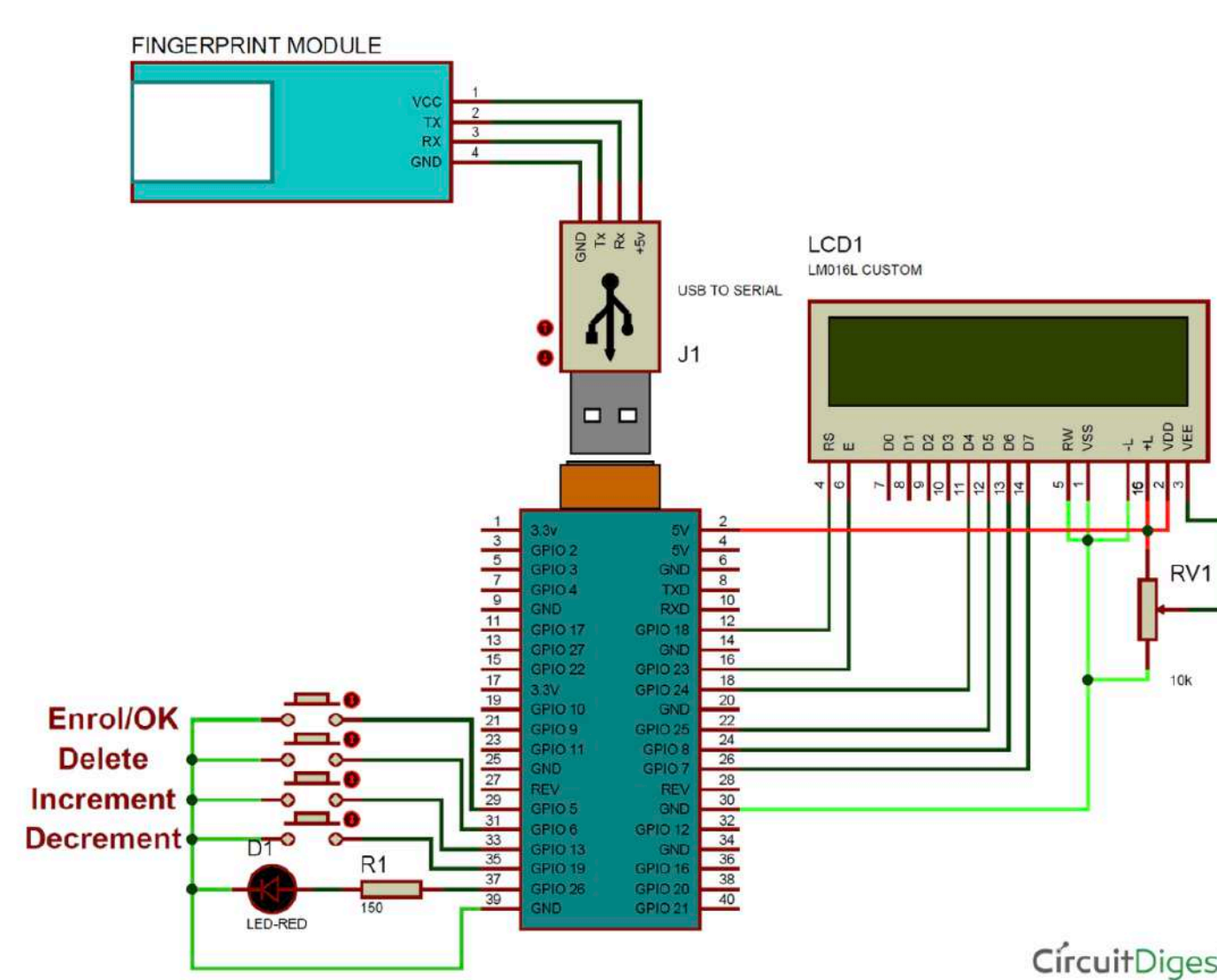
Dataset

(a) Real Fingerprint

(b) Fake Fingerprint

Components

Raspberry Pi 4B
Fingerprint Sensor R307
ST7735 LCD Display
54GB SD Card
USB to VART Serial Converter RTC Module
Breadboard and Jumper Wires, Push Buttons.

Algorithm

RESULTS

Model	Dataset	Accuracy
Resnet-18	CrossMatch	98
	GreenBit	98
	Average Cross Sensor	98

CONCLUSION

CrossMatch, GreenBit, and Average Cross Sensor datasets demonstrate a notable 98% accuracy post-training with machine learning models. This high accuracy highlights their effectiveness in biometric authentication applications, ensuring reliable and secure identification processes. Achieving such precision underscores their value in mitigating risks associated with spoofing and unauthorised access.

Introduction

Access to clean and safe drinking water remains a significant challenge in many parts of the world, especially in remote areas and during outdoor activities To address this issue, we embarked on a project to develop a water quality monitoring sensor capable of evaluating the purity of water from natural sources.
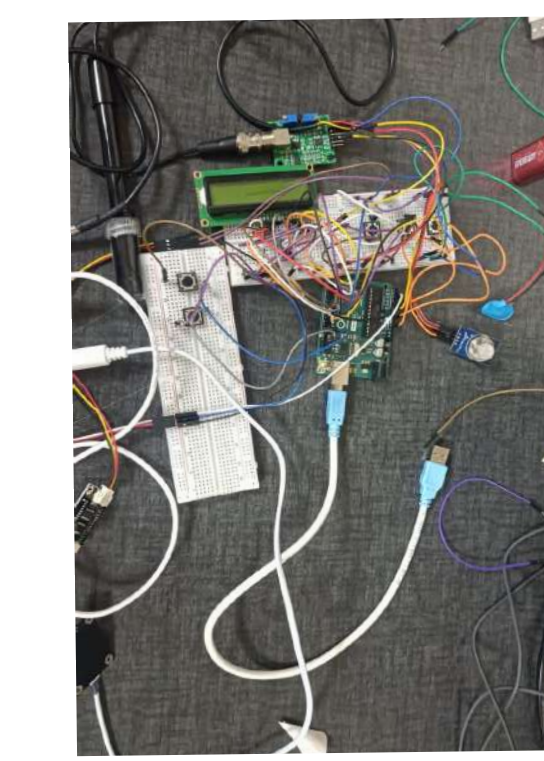
Objective

The core objective of our project is to design and build a sensor system that can measure key water quality parameters: pH, turbidity, conductivity, and temperature. By integrating these sensors into a single device, we hope to provide a comprehensive tool for water quality assessment.

Components

i)Sensors
• pH sensor
• TDS sensor
• Conductivity sensor
• Temperature sensor
• MQ135 sensor

ii) Micro controller n display
• Arduino Mega
• ST7735 display

iii) Others
• Breadboard
• 9V battery

Final Prototype

Results and Conclusion

The core objective of our project is to design and build a sensor system that can measure key water quality parameters: pH, turbidity, conductivity, and temperature. By integrating these sensors into a single device, we hope to provide a comprehensive tool for water quality assessment.
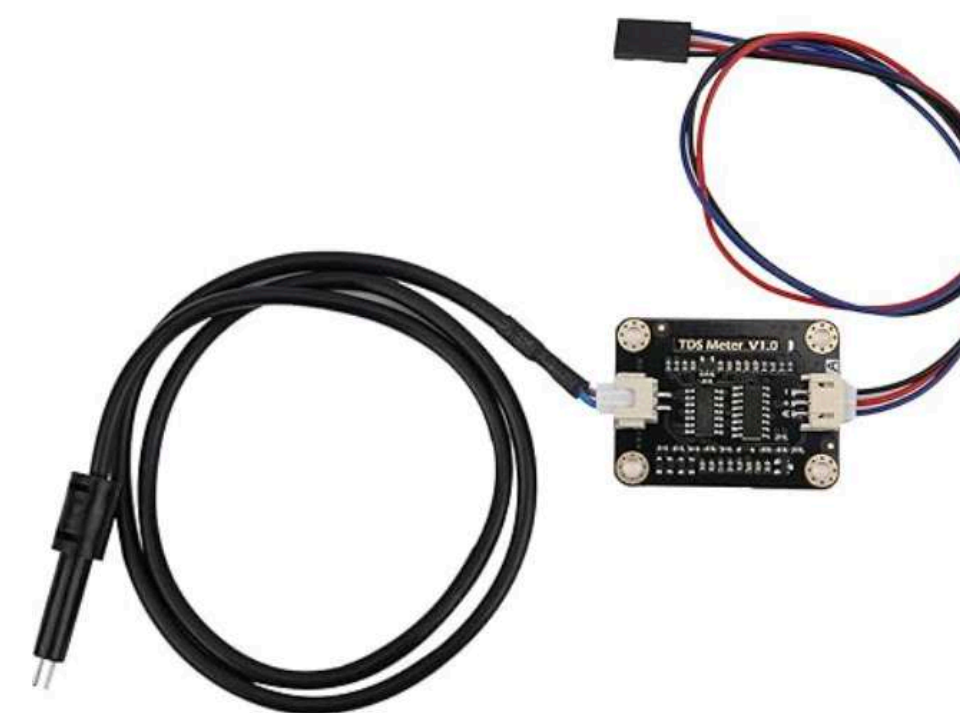
pH sensor

A pH sensor works by measuring the potential difference generated by a glass electrode in response to the hydrogen ion concentration in a solution.

Conductivity sensor

A conductivity sensor works by measuring the ability of a solution to conduct an electric current, which is directly related to the concentration of ions in the solution.

Temperature Sensor

The DS18B20 temperature sensor operates digitally, measuring temperature through a built-in sensor and transmitting data via a single-wire digital interface.

TDS Sensor

A TDS sensor operates by measuring the electrical conductivity of a liquid solution, reflecting the concentration of dissolved solids.

MS135 Sensor

A TDS sensor operates by measuring the electrical conductivity of a liquid solution, reflecting the concentration of dissolved solids.