Utility Gloves for Vocally Challenged People

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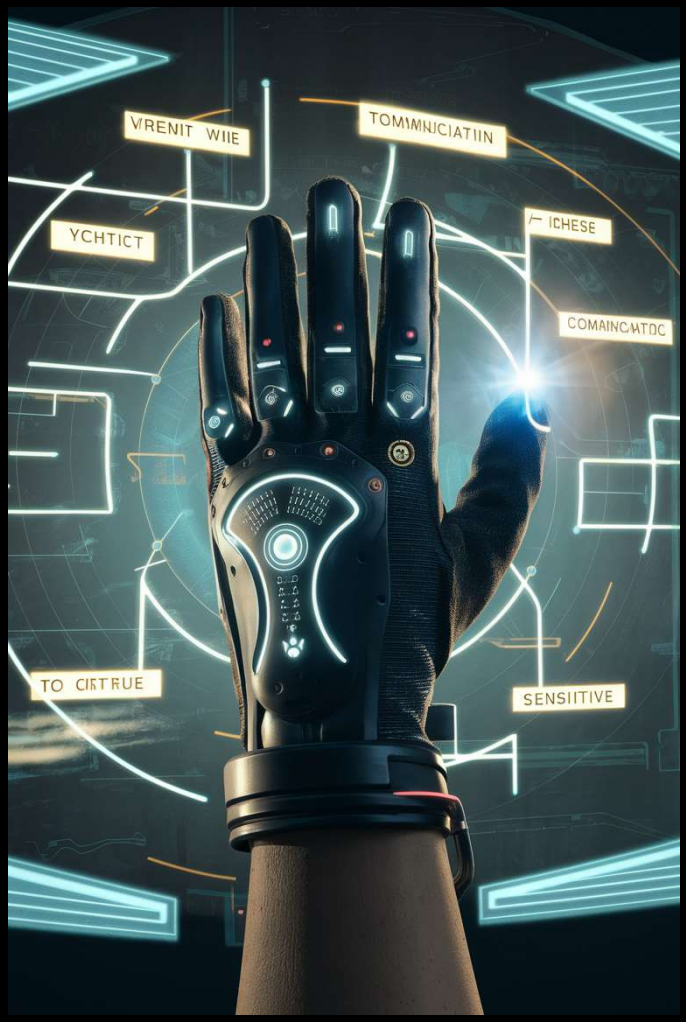
OVERVIEW

Purpose: Enhance communication for vocally challenged individuals.

Approach: Develop utility gloves that translate hand gestures into speech.

Technologies: Embedded systems and IoT.



PROJECT MOTIVATION

Vocally challenged individuals face significant communication barriers in daily life, with limited existing solutions. This project aims to create an intuitive and efficient assistive device to bridge this communication gap

LITERATURE REVIEW

Brief Literature Review:

- **Existing Solutions:**
  - Several assistive devices for vocally challenged individuals exist, including text-to-speech apps and wearable devices.
- **Gesture Recognition Technology:**
  - Research on using flex sensors and accelerometers for gesture recognition has shown promising results in improving accuracy and responsiveness.
- **Embedded Systems and IoT:**
  - Recent advancements in microcontrollers and wireless communication have enabled the development of compact, efficient, and cost-effective assistive devices.

CONCEPT AND DESIGN

Core Concept:

- Gloves with embedded sensors to detect hand gestures.
- Data processing via microcontrollers.
- Speech output through a connected device (e.g., smartphone).

METHODOLOGY

Technology:

- **Arduino Nano Microcontroller:**
  - Captures and processes input data from the flex sensors or jumpers embedded in the gloves.
- **HC-05 Bluetooth Module:**
  - Transmits processed data wirelessly to a connected smartphone.
- **Smartphone Application:**
  - Receives data via Bluetooth, interprets gestures, and converts them into speech using text-to-speech technology.

Future Modifications:

- Integrating advanced sensors such as accelerometers for more precise gesture recognition.
- Implementing real-time sign language interpretation for more comprehensive communication support.

IMPLEMENTATION OPTIONS

Basic Prototype Implementation:

- Arduino Nano microcontroller.
- HC-05 Bluetooth module.
- Basic gesture detection with simple commands.

Enhanced Implementation Possibilities:

- Integration of flex sensors for detailed gesture recognition.
- Advanced processing algorithms for accurate interpretation.
- Additional features like speaker output and LED displays.

SYSTEM COMPONENTS

Hardware:

•Arduino Nano microcontroller.

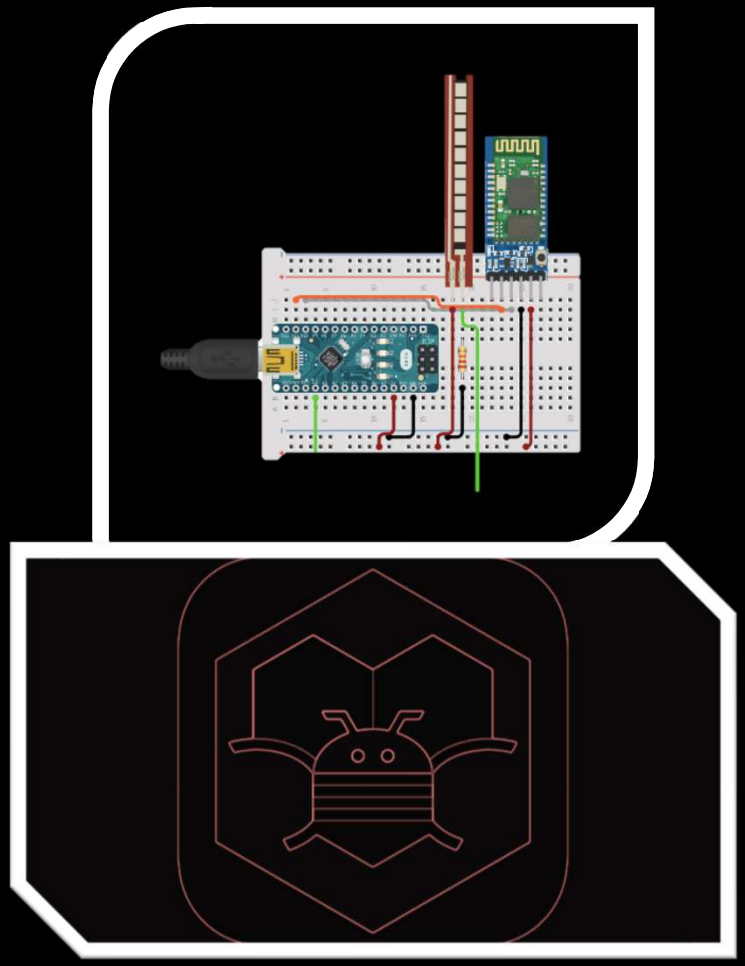
•HC-05 Bluetooth module.

•Flex sensors.

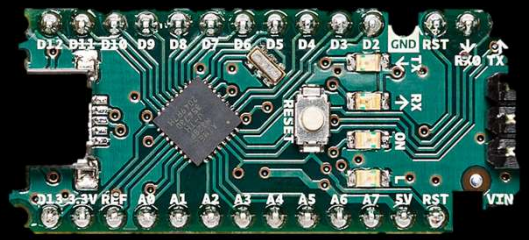
Software:

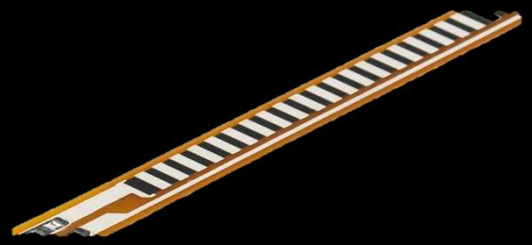
•Gesture recognition algorithms.

•Smartphone application for text-to-speech conversion using MIT App Inventor.



HARDWARE COMPONENTS





Arduino Nano Microcontroller

Acts as the brain of the system, processing input from sensors and sending data to the Bluetooth module

HC-05 Bluetooth Module

Facilitates wireless communication between the glove and a smartphone or other Bluetooth-enabled devices

Flex Sensors (Optional)

Embedded in the gloves to detect and measure the degree of bending in the fingers, enabling gesture recognition

SOFTWARE CONSTRUCTION

MIT App Inventor:

•Visual programming environment for creating mobile apps.

•Enables rapid development and deployment of the smartphone application.

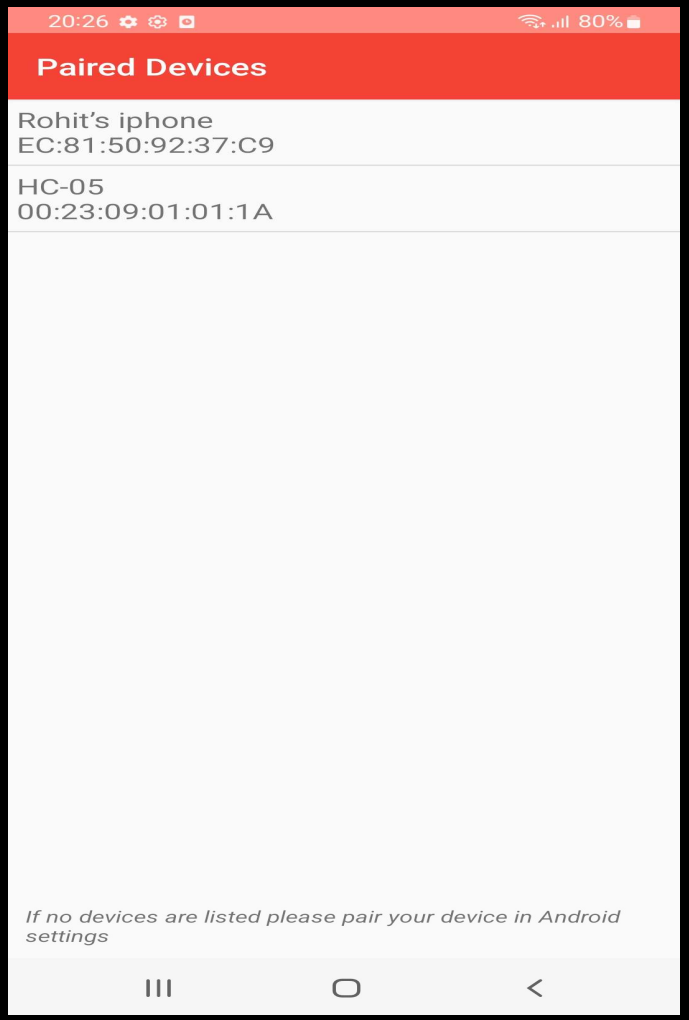
Features of the App:

•Bluetooth connectivity to receive data from the gloves.

•Real-time communication interpretation.

•Text-to-speech conversion to vocalize gestures.

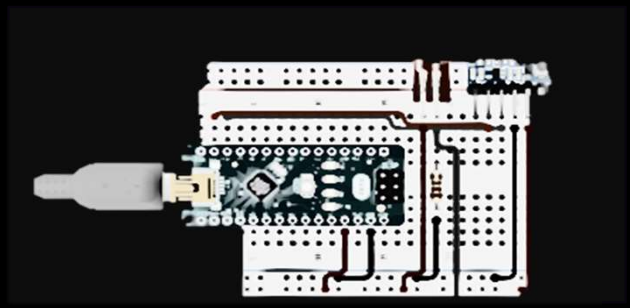
•User-friendly interface for easy interaction.



WORKING MECHANISM

```
oid loop() {
 for (int i = 0; i < 4; i++) {
   if (digitalRead(fingerPins[i]) == LOW) {
     Serial.println(messages[i]);
     BTSerial.println(messages[i]);
     delay(1000); // Debounce delay
   }
 }
 delay(500); // Short delay to avoid flooding the Serial Monitor
```

```
void setup() {
  Serial.begin(9600);   // Start serial communication for debug
  BTSerial.begin(9600); // Start Bluetooth serial communication
  for (int i = 0; i < 4; i++) {
    pinMode(fingerPins[i], INPUT_PULLUP); // Finger pins with p
  }
  Serial.println("Setup complete. Starting loop.");
  BTSerial.println("Setup complete. Starting loop.");
}
```



LOOP

Loop Function:

•Continuously checks the state of each finger pin.

•If a pin is pressed (LOW state), it sends the corresponding message to the Serial Monitor and via Bluetooth to the smartphone.

PULLUP

•**Purpose:** Ensures the input pins are at a known HIGH state when not activated

Mechanism: Uses internal resistors to pull the input to a HIGH state by default and when the finger bends and the circuit closes, the input reads LOW

Operations

When a finger bends, the corresponding pin reads LOW.

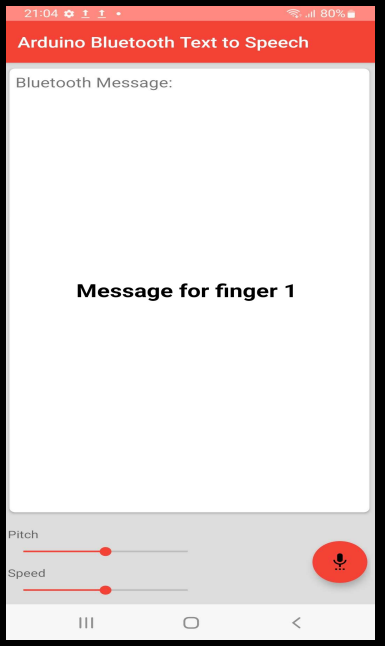
The Arduino sends the predefined message to the connected smartphone via HC-05.

he smartphone displays the received message, translating gestures into text.

TESTING

Testing Process:

- **Setup:**
  - Verify hardware connections and power.
- **Unit Testing:**
  - Test finger pins for detection and Serial Monitor output.
- **Integration Testing:**
  - Establish Bluetooth connection.
  - Confirm message display on the smartphone.
- **System Testing:**
  - Perform end-to-end tests for gesture-to-text translation.
- **User Testing:**
  - Gather and implement feedback from users.



BENEFITS AND APPLICATION

Advantages:

•Convenient and intuitive communication tool.

•Potential to significantly improve quality of life.

•Cost Effective

Applications:

- Daily communication.
- Education and learning tools.
- Integration with smart home devices.

FUTURE ENHANCEMENTS

Planned Enhancements:

- More sophisticated gesture recognition algorithms.
- Integration of additional sensors (e.g., accelerometers).
- Improved user interface and experience.

Long-Term Goals:

- Market readiness.
- Collecting user feedback for continuous improvement
- Making it as affordable as possible

ACKNOWLEGDEMENT

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