AI-Based Sensory Glove System to Recognize Bengali Sign Language (BaSL)

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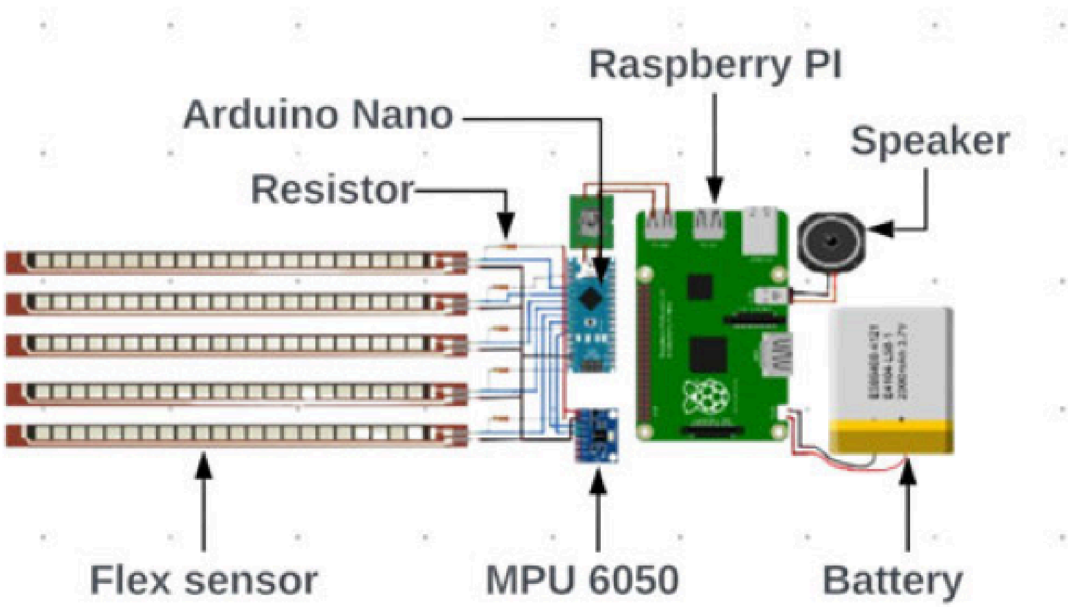
1. Summary of the Paper

This paper introduces the glove based bangla sign language recognition system, they proposed two architectures one is CNN based and other is combination of CNN and LSTM.Both of these framework worked very well and gave solid accuracy,overall they proposed a very accurate and efficient methods.

2.Components Used

1. FLEX SENSORS: Measures Finger Angle
2. : linear acceleration + gravity along X, Y, Z axes
3. GYROSCOPE: how fast something is rotating around an axis.
4. AURDUINO NANO: Data collection
5. RASPBERRY PI: For inferencing



3. Weaknesses / Limitations

- They only used 41 bangla words for training and testing
- Only used one handed sign words.
- This paper is not fully complete for the task as they only used limited words.
- Design of glove and inference system is not user friendly. As the whole setup is very bulky

An Intelligent Android System for Automatic Sign Language Recognition and Learning

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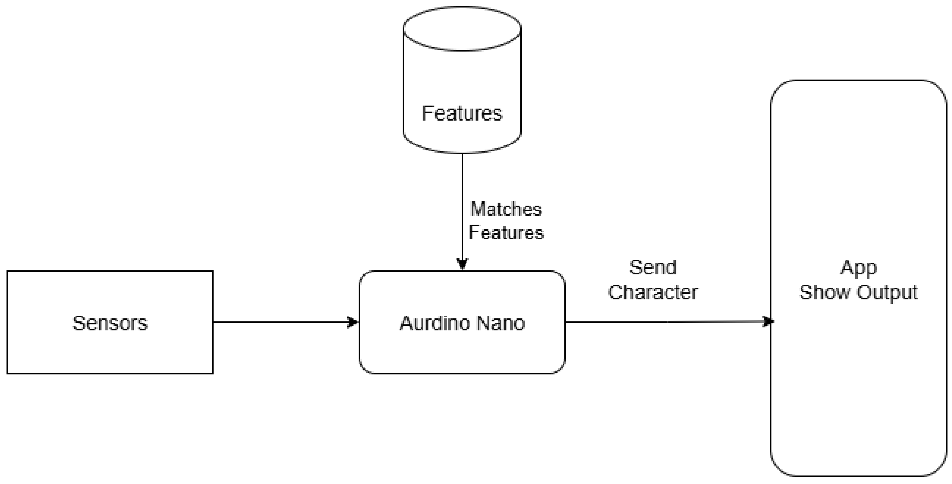
1. Summary of the Paper

This paper converts english and arabic sign language to displays them to android app. The app also uses marker based Augmented Reality for efficient learning for the deaf and mute people using the android app. They create a table of features for each sign and stored them in a database. The microprocessor just matches the captured gesture sensors values with the already stored table and comes to decision



2.Components Used

1. FLEX SENSORS: Measures Finger Angle
2. ACCELEROMETER: linear acceleration + gravity along X, Y, Z axes
3. GYROSCOPE: how fast something is rotating around an axis.
4. AURDUINO NANO: Data collection
5. Android App

3. Weaknesses / Limitations

- They used alphabets rather than words which are very tedious
- The paper does not uses Any deep learning model

Development of a Real-Time Hand Gesture Recognition System for Aid of Hearing-Impaired Communication Using Flex Sensors and Machine Learning Algorithms

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2024 8th SLAAI - International Conference on Artificial Intelligence, SLAAI-ICAI 2024

1.Summary:

The research details the development of a real-time hand gesture recognition system aimed at bridging the communication gap for hearing-impaired individuals. The system uses a glove equipped with flex sensors to convert hand movements into electrical signals. It employs machine learning algorithms, specifically Support Vector Machine (SVM), Naive Bayes, and K-Nearest Neighbors (KNN), to classify the gestures. The system was able to achieve a more accurate and precise result by successfully displaying ten messages corresponding to the detected gesture on a Graphical User Interface (GUI).

2.Components Used:

Flex sensors: Attached to each finger of a glove to measure the bend of the fingers.
Arduino Nano Board: Used to read the analog output voltage from the flex sensors.
nRF24L01 transmitter module: Utilized for remote and wireless communication.
9V battery: Provides power to the system's devices.
Resistor and Capacitor: Used in the circuit for the flex sensors

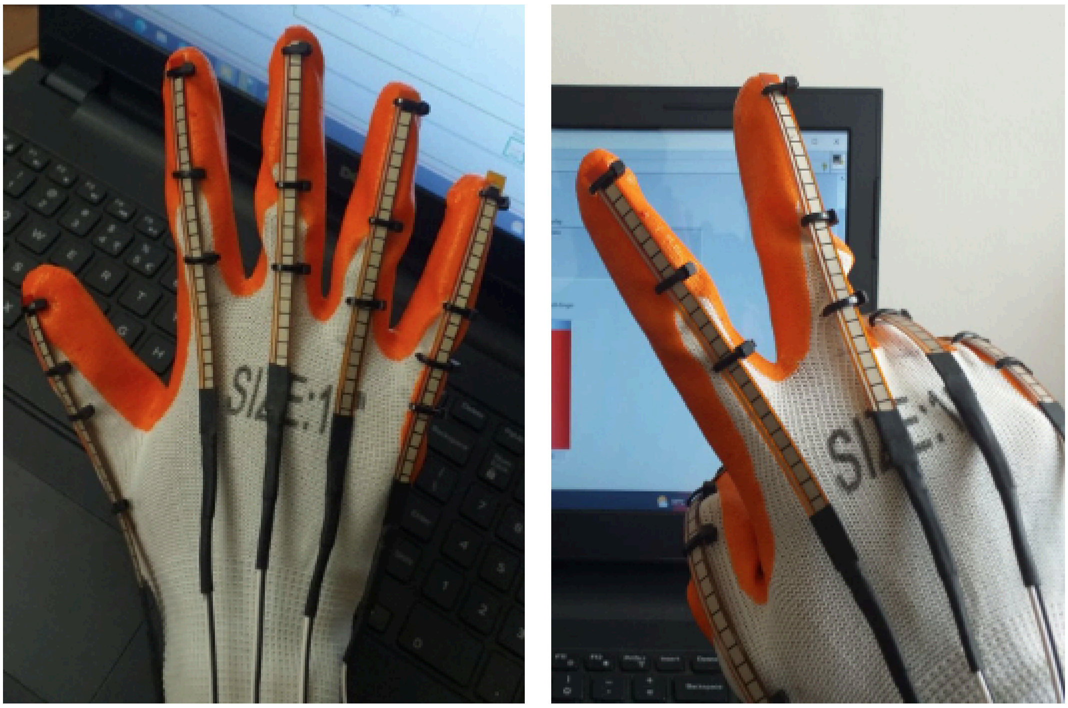


Fig. 2. Flex sensors-based glove of the hand gesture recognition system

3.Limitations:

- The different hand sizes of users present a major challenge, which can be addressed by training the model with a larger number of people and introducing different sizes of gloves.
- More complex gestures could be recognized by connecting and enhancing a gyro sensor and accelerometer on the glove.
- Future work includes converting complete sign language into voice commands or messages

Proposed IDEA

Sign Language Glove to Android Translation System: Workflow

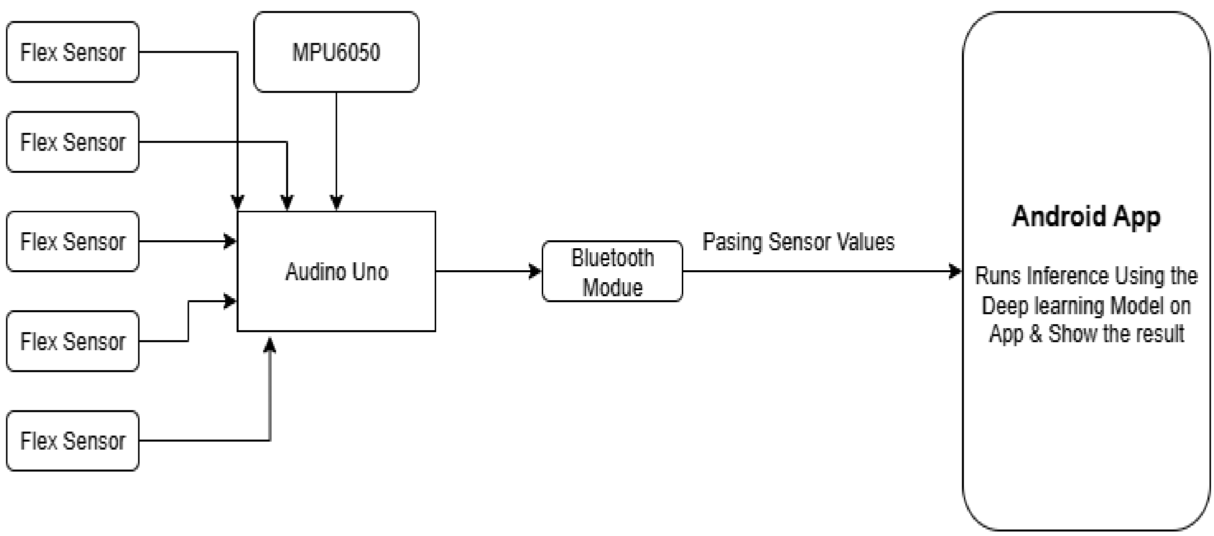
1. Hardware Setup (Glove)

Components:

- Arduino Nano (microcontroller)
- Flex sensors (for finger bending detection)
- IMU (gyroscope + accelerometer for hand orientation and motion tracking)
- Bluetooth module (HC-05 for Android, HM-10 for iOS)

The flex sensors and IMU are connected to the Arduino's analog/digital pins. The Arduino continuously reads raw sensor values from these components.

Project Overview



2. Real-time Workflow

- **Glove:** Sensors capture finger bending and hand motion data.
- **Arduino Nano:** Formats sensor data and transmits it via Bluetooth.
- **Android App:**
  - Receives real-time data.
  - Preprocesses and feeds it into the ML model.
  - Generates predictions (e.g., "Hello", "Yes", "No").
  - Displays recognized sign as text and provides audio output if enabled.

3. Data Collection (Training Phase)

During the training phase, the Arduino transmits raw sensor values to a PC via USB Serial for dataset creation.

Example dataset format (CSV):

```
flex1,flex2,flex3,flex4,flex5,gyroX,gyroY,gyroZ,accX,accY,accZ,label
320,400,280,450,500,-0.12,0.45,0.33,1.02,-0.20,0.50,Hello
```

Multiple samples per gesture are collected from different users to ensure generalization. The dataset is stored in CSV or JSON format for further processing.

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4. Android Application Development

- **Bluetooth Service:** Establishes connection with Arduino (HC-05).
- **Data Receiver:** Collects real-time sensor values transmitted from the glove.
- **ML Inference Engine:** Loads the TensorFlow Lite model, preprocesses input data, and runs predictions.
- **User Interface and Text-to-Speech (TTS):** Displays the recognized gesture as text and optionally outputs speech.