Home Automation: Control Your Home with Ease

Project Overview

In our Home Automation extravaganza, we've taken things up a notch! No need for sensors here—just your expressive hand gestures doing the talking. Thanks to the magic of Machine Learning, your nuanced movements become a language that our system understands, allowing you to effortlessly command your home environment.

It's like conducting a tech orchestra with the flick of a wrist or the wave of a hand. So, who needs buttons when you can dance your way to the perfect lighting and temperature? Welcome to the future of hands-on home control, now in stunning 144p!

Functions

Gesture Control

- Users can control smart home devices with hand gestures.
- Gesture recognition technology allows for hands-free control.

Device Compatibility

- Compatible with a wide range of smart home devices.
- Allows for seamless integration with existing home automation systems.

Dependencies

We've streamlined our tech lineup for the Home Automation remix:

Mediapipe: Adding finesse with hand contours during training, because details matter.

OpenCV: The master conductor of input/output, making sure the data flow is on point.

TensorFlow: The brainiac behind understanding your gestures—no Terminator drama, just smart home magic.

Pandas, NumPy, Matplotlib: The trio pulling off number-crunching and visualizations with style.

Now, introducing the new stars:

Arduino: Stepping up as the powerhouse, replacing the Raspberry Pi 3 Model B+. It's the muscle ensuring your home follows the rhythm of your gestures.+ pocket friendly

Python 3.7 : The language of choice, because Python is always in vogue.

OpenCV library: The essential toolkit for image processing, capturing your gestures with precision.

With this streamlined lineup, your home is not just automated—it's an orchestra of tech brilliance, now with an Arduino-powered beat!

Behind the Scenes

of

Wave, Swipe, Magic: Your Home, Your Rules

Let's untangle those technical intricacies together

A brief intro

Greetings! We're a dynamic trio on a mission. I'm Dibyendu Mondal, your software sherpa, accompanied by the wizard behind the screen, Shubhradip Sarkar. Together, we'll unravel the software intricacies. On the hardware front, we've got Arkaprava Manna, our maestro. Big shoutout to Nc sir for this opportunity to showcase teamwork in action. Now, let's dive into the realms of software, hardware, and, of course, nail that presentation!

Algorithm for recognizing gestures:

Acquiring Data:

-Utilizing ***Mediapipe*** to capture hand movements, generating a rich dataset of x, y, z coordinates.

Data Preprocessing:

- Cleaning and organizing the dataset for optimal training performance.

- Applying normalization techniques to ensure uniformity in input.

Model Architecture:

- Introducing LSTM (Long Short-Term Memory) models for sequence learning.

- Designing a neural network that understands the temporal aspect of hand gestures with ***Tensorflow***

Training Phase:

- Iteratively training the model on the preprocessed dataset.

- Fine-tuning parameters to enhance accuracy.

- Leveraging Pandas and NumPy for efficient data manipulation during training.

Mapping to Actions:

- Developing a mapping mechanism to associate LSTM model predictions with specific home automation commands.

- Creating a seamless interface between predicted gestures and desired functions.

Voila! Software Implementation

Automated Home Management.

Software implementation done!

Deploying AI model in home automation.

Controlling the environment with your gestures.

Storing and Managing Data.

Collecting data.

Collecting data for continuous improvement efficiently.

Building a comprehensive dataset for future upgrades.

Extracting features.

Identifying key data features to enhance model comprehension.

Classifying Gestures.

Classifying gestures accurately using classification techniques.

Control devices.

Enabling precise device control via recognized gestures.

Control of Scenes.

Managing and enhancing pre-defined scenes for better user experience.

This flowchart controls your smart home with hand gestures.

Uploading code to an Arduino:

where bits and bytes take a detour through the land of resistors and transistors, just for kicks

Meet ***Arkaprava Manna***, the hardware maestro of the team. Time to dive into the nuts and bolts with a touch of his technical wizardry.

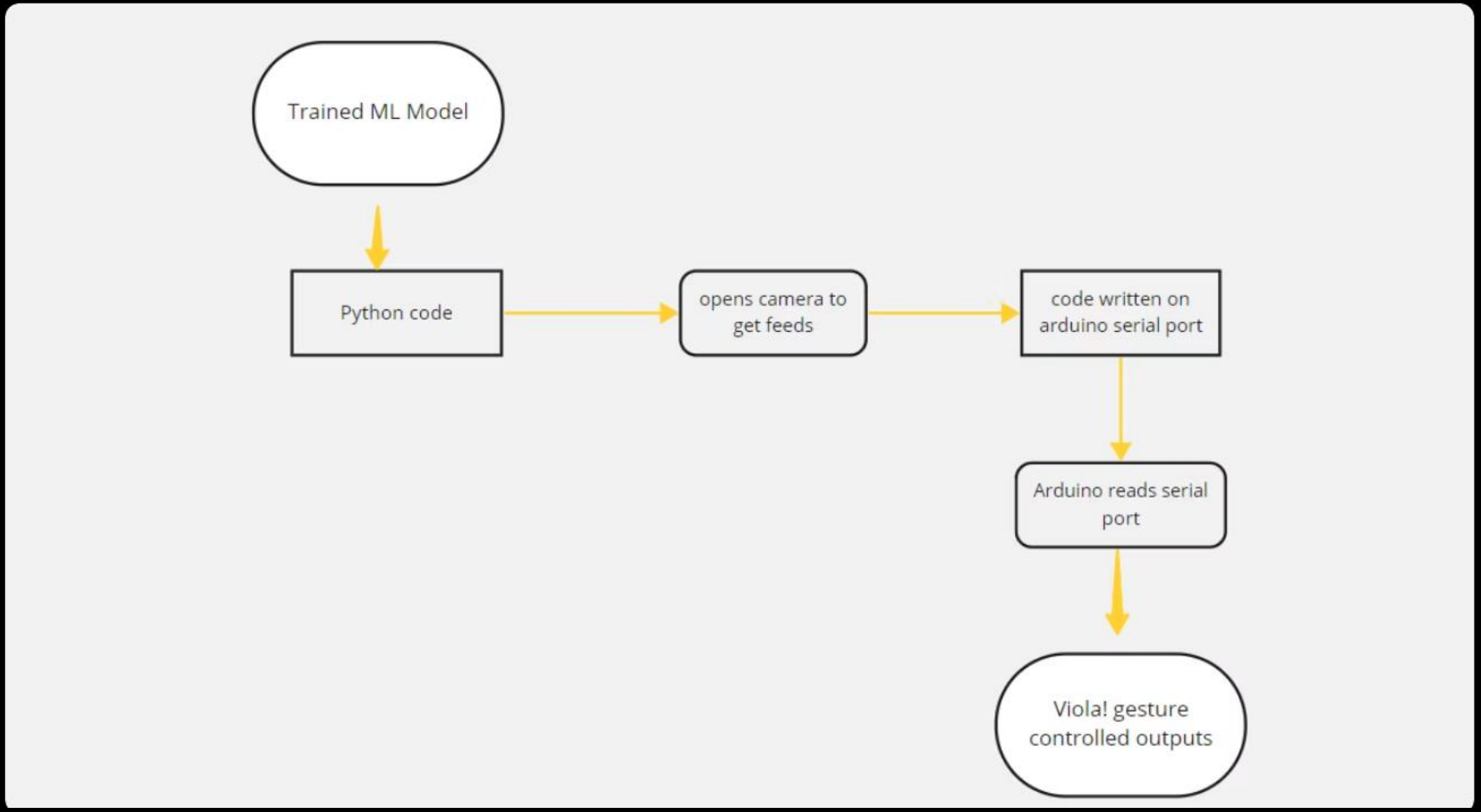
"Gesture Recognition System: Interfacing Python with Arduino for Real-time Hand Sign Detection and Control"

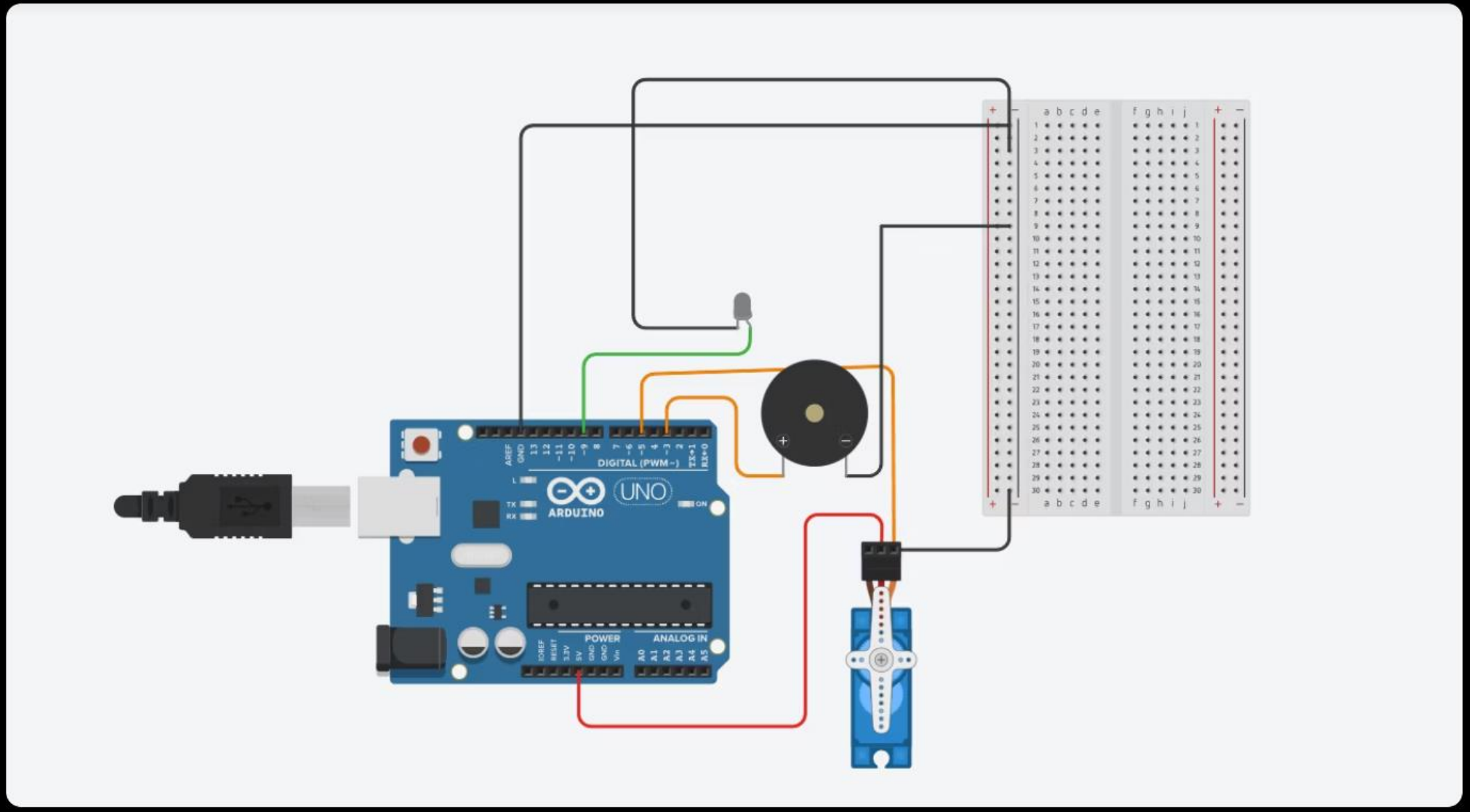
This innovative project combines ***Python*** and ***Arduino*** to create a ***Gesture Recognition System***. The Python script utilizes image processing techniques to detect hand signs, and through the ***PySerial*** module, communicates specific commands to an Arduino. The Arduino, in turn, interprets these commands and executes programmed tasks, forming a seamless interaction between software and hardware for real-time control based on hand gestures. This dual-code system showcases the integration of computer vision and microcontroller technology, opening avenues for diverse applications in human-computer interaction and automation.

Instruction Set

Right Hand open	Light(LED) ON!
Right Hand fist	Light(LED) OFF!
Right Hand OK	Servo ON!!!
Right Hand Clockwise	LED Fast Blinking
Right Hand Counter clockwise	Fire Alert!!
Left Hand open	PPT opening

Flow Chart


Trained ML Model
Python code
opens camera to get feeds
code written on arduino serial port
Arduino reads serial port
Viola! gesture controlled outputs



Hardware Circuit Diagram

Contributors and Contributions

Name	*Role Number*	*Contribution*
Arkaprava Manna	20EC8005	Hardware and Circuit Design
Dibyendu Mondal	20EC8014	Ai training , modelling and ppt making
Shubhradip Sarkar	20EC8030	Demostration and code optimization

It was a fun project to do got to learn lot of new stuff and got hands on experience AI modelling and training along with exposure to hardware.

Thank you so much sir 😊