Final Project IoT

ESP32-LNW - A Study Into the Implementation of IoT for Accessibility Purposes

Group A8

Team Member

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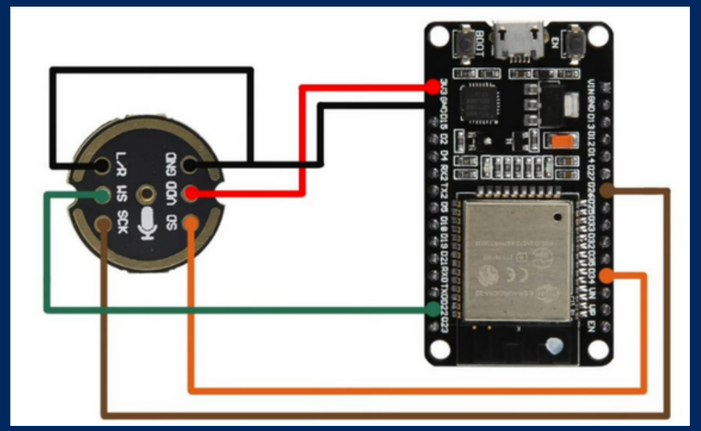
Problem

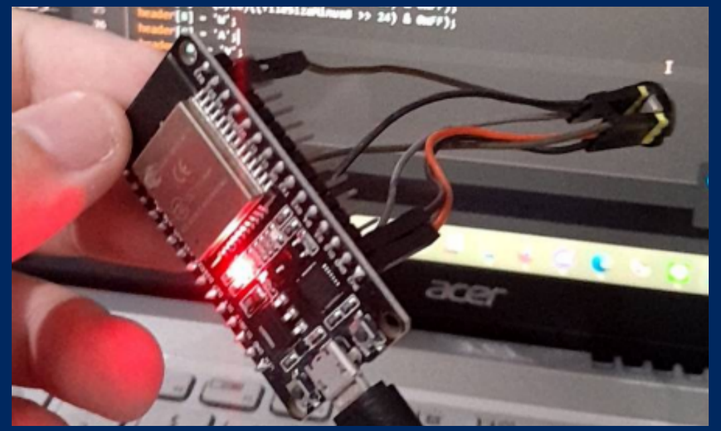
In the rapidly evolving landscape of Internet of Things (IoT) applications, voice interaction has emerged as a compelling interface for user engagement. The integration of Speech-to-Text (STT) technology into IoT projects allows for natural and intuitive communication between users and connected devices.

Solution

The ESP32-LNW project presents a novel solution to the challenges mentioned. It utilizes the ESP32 microcontroller and INMP441 I2S microphone for converting audio signals to text efficiently and accurately in real-time. The integration of MQTTS protocol enhances versatility, allowing smooth communication with other IoT devices.

Hardware Design





Software Design

Blynk

Google Cloud

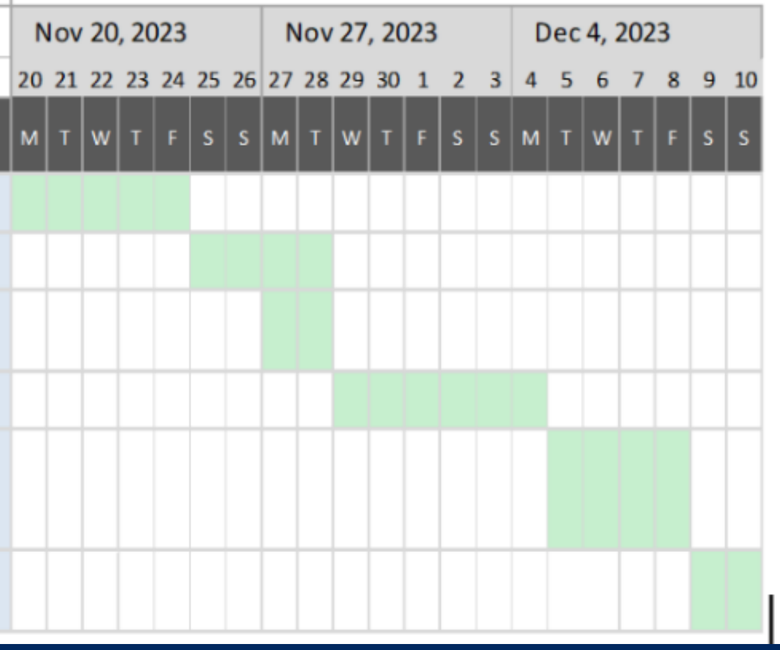
Gantt Chart

Final Project Internet of Things

Kelompok A8

Project Start:	Sat, 11/25/2023
Project End:	Mon, 12/11/2023
Display Week:	1

TASK	ASSIGNED TO	START	END
Brainstorming Idea	All	11/20/23	11/24/23
Buying Equipment	Armond	11/25/23	11/28/23
Hardware Design completion	All	11/27/23	11/29/23
Software Development	All	1/13/19	1/18/19
Integration and Testing of Hardware and Software	Armond & Stefan	1/6/19	1/8/19
Final Product Assembly and Testing	Adrien & Brian	1/7/19	1/9/19



User Manual

User Guide
ESP32-LNW

Arsitektur Produk

Panduan Penggunaan Perangkat

Langkah 1: Persiapan

1. Pastikan sensor INMP441 terhubung dengan mikrokontroler ESP32.
2. Nyalakan perangkat dan periksa indikator LED untuk memastikan setup hardware berhasil.
3. Instal Arduino IDE dan perpustakaan yang diperlukan
4. Konfigurasi kredensial Wi-Fi dengan memperbarui variabel 'ssid' dan 'password' pada kode.

Langkah 2: Operasional

1. Buka Arduino IDE dan unggah kode yang disediakan ke mikrokontroler ESP32
2. Setelah diunggah, buka monitor serial untuk melihat pesan inisialisasi perangkat.
3. Gunakan aplikasi Blynk untuk mengontrol proses perekaman. Saat tombol 'PLAY' ditekan, perangkat mulai merekam audio dari sensor INMP441.
4. Monitor serial akan menampilkan durasi perekaman dalam menit dan detik.
5. Setelah durasi perekaman mencapai waktu yang ditentukan (default: 5 menit), perangkat secara otomatis berhenti merekam dan mentranskripsi audio yang direkam ke teks menggunakan Google Cloud Speech-to-Text API.

Langkah 3: Pemantauan

1. Lihat status perangkat (PLAY, STOP, atau IDLE) pada aplikasi Blynk dengan memonitor Virtual Pin V2.
2. Monitor serial memberikan pembaruan real-time tentang proses perekaman dan timestamp.

Troubleshoot Perangkat

1. Jika terjadi kesalahan atau masalah, reset perangkat dan periksa koneksi antara ESP32 dan sensor INMP441.
2. Pastikan koneksi Wi-Fi berfungsi dengan baik untuk operasi yang lancar.

Testing

Test 1

"This is our final project for the Internet of Things class. The device will record this sound and write it into the serial monitor."

Result 1

```
21:44:26.268 -> My Answer - HTTP/1.1 200 OK
21:44:26.268 -> Content-Type: application/json; charset=UTF-8
21:44:26.268 -> Vary: X-Origin
21:44:26.268 -> Vary: Referer
21:44:26.268 -> Date: Sun, 10 Dec 2023 14:31:16 GMT
21:44:26.268 -> Server: ESF
21:44:26.268 -> Cache-Control: private
21:44:26.268 -> X-XSS-Protection: 0
21:44:26.268 -> X-Frame-Options: SAMEORIGIN
21:44:26.268 -> X-Content-Type-Options: nosniff
21:44:26.268 -> Alt-Svc: h3=":443"; ma=2592000,h3-29=":443"; ma=2592000
21:44:26.268 -> Accept-Ranges: none
21:44:26.268 -> Vary: Origin,Accept-Encoding
21:44:26.303 -> Transfer-Encoding: chunked
21:44:26.303 ->
21:44:26.303 -> 44
21:44:26.303 -> {
21:44:26.303 ->   "totalBilledTime": "10s",
21:44:26.303 ->   "requestId": "3754470959990385904"
21:44:26.303 -> }
21:44:26.303 ->
21:44:26.303 -> 0
21:44:26.303 ->
21:44:26.303 -> 394
21:44:26.303 -> Json data--{
21:44:26.303 ->   "totalBilledTime": "10s",
21:44:26.303 ->   "requestId": "3754470959990385904"
21:44:26.303 -> }
21:44:26.303 ->
21:44:26.303 -> 0
21:44:26.303 ->
21:44:26.303 -> Transcript: This is the final project for Internet of Things class. Device will record its sound and write into the serial monitor.
```

Test 2

"This test will check how accurate the device is to record our voice and based on what we said."

Result 2

```
21:43:21.670 -> Content-Type: application/json; charset=UTF-8
21:43:21.670 -> Vary: X-Origin
21:43:21.670 -> Vary: Referer
21:43:21.670 -> Date: Sun, 10 Dec 2023 14:31:16 GMT
21:43:21.670 -> Server: ESF
21:43:21.670 -> Cache-Control: private
21:43:21.670 -> X-XSS-Protection: 0
21:43:21.670 -> X-Frame-Options: SAMEORIGIN
21:43:21.670 -> X-Content-Type-Options: nosniff
21:43:21.702 -> Alt-Svc: h3=":443"; ma=2592000,h3-29=":443"; ma=2592000
21:43:21.702 -> Accept-Ranges: none
21:43:21.702 -> Vary: Origin,Accept-Encoding
21:43:21.702 -> Transfer-Encoding: chunked
21:43:21.702 ->
21:43:21.702 -> 44
21:43:21.702 -> {
21:43:21.702 ->   "totalBilledTime": "10s",
21:43:21.703 ->   "requestId": "3754470959990385904"
21:43:21.703 -> }
21:43:21.703 ->
21:43:21.703 -> 0
21:43:21.703 ->
21:43:21.703 -> 394
21:43:21.703 -> Json data--{
21:43:21.703 ->   "totalBilledTime": "10s",
21:43:21.703 ->   "requestId": "3754470959990385904"
21:43:21.703 -> }
21:43:21.703 ->
21:43:21.703 -> 0
21:43:21.703 ->
21:43:21.703 -> Transcript: This test will check how accurate the device is to record our voice based on what we say..
```

In Example 1, a total of 4 out of 22 words exhibited inaccuracies in transcription. In Example 2, 3 out of 19 words were not transcribed accurately. It's noteworthy that the inaccuracies primarily occurred in specific technical terms and were influenced by factors such as pronunciation variations and background noise.

Evaluation

ESP32-LNW's evaluation revealed overall commendable accuracy despite some identified inaccuracies in transcribing technical and casual speech. Factors like technical term complexities, pronunciation variations, and background noise influenced discrepancies. The test highlighted strengths and improvement areas, affirming success in addressing communication challenges. Future focus includes continuous refinement for better accuracy across real-world scenarios, forming the basis for ongoing evolution of this IoT solution.

Thank You