CLOUD-BASED VOICE RECOGNITION SECURITY SYSTEM

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OBJECTIVE
- Develop a cloud-based voice recognition system that identifies BECU members as they speak with an employee at a Neighborhood Financial Center in the United States.
- Real-time voice recognition from captured audio streams.
- Provide a second layer of authentication (after PIN verification) that strengthens security, reduces caller fraud, and maintains operation efficiency.

SYSTEM OVERVIEW & WEB DEVELOPMENT

FRONT-END
- Implemented with Azure Static Web Apps [1]
- Built the website with HTML5, CSS3, and JavaScript.
- Azure Cognitive Services Speaker Recognition [3][4] in JavaScript:
  - Text-Dependent
  - Enrollment: 3 Audio Recordings
  - Verification: 1 Audio Recording

ADMIN PORTAL
- Admin Login Page: Allow BECU employees to sign into admin portal.
- Add New Customer Page: Register customers and enroll voice signatures.
- Customer Database Page: Verify customers with security questions and voice recognition.

BACK-END: DATABASE
- Implemented with Azure SQL Database [6]
- Stores customer information when they are enrolled for the first time.
- Stores employee credentials and system performance metrics.
- Connects with Azure Cognitive Services to store the Voice Profile ID generated to verify the customer.

BACK-END: API
- Implemented with Azure Functions [5] in Python
- Builds the web API with a RESTful and serverless architecture.
- Handles HTTP requests using HTTP trigger function.
- Responds to database transactions with pyodbc package.

MACHINE LEARNING RESULTS
- The voice signature of 17 users were enrolled with recordings in quiet environments.
- Thresholds: Reject = <70%; Further Verification = 70-80%; Accept = >80%

Table 1: Testing Scenarios
(1) quiet environments, (2) noisy environments, (3) users spoke slowly, & (4) users spoke quickly.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Native Speakers</th>
<th>Non-Native Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiet</td>
<td>0.9179</td>
<td>0.8996</td>
</tr>
<tr>
<td>Noisy</td>
<td>0.3529</td>
<td>0.5294</td>
</tr>
<tr>
<td>Slow</td>
<td>0.7550</td>
<td>0.1176</td>
</tr>
<tr>
<td>Fast</td>
<td>0.0000</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

CONCLUSION & FUTURE WORK

Our team successfully:
- Developed a web application to achieve a cloud-based voice recognition solution.
- Authenticates new and existing members within 30 sec with >80% confidence level.
- Used accessible microphones to capture live audio streams and perform real-time voice recognition.
- Deployed Microsoft Azure resources for effective and secure cloud-based functionalities that can be easily integrated with BECU’s existing infrastructure and flexible to scale-up.

Future Goals:
- Explore Blockchain as an alternative to SQL database.
- Further test the MS Speaker Recognition API against a more diverse, large dataset.

REFERENCES