

BAB V

KESIMPULAN DAN SARAN

5.1 KESIMPULAN

Berdasarkan hasil penelitian dan pengujian yang telah dilakukan, dapat disimpulkan bahwa:

1. Sistem chatbot layanan informasi akademik berhasil diimplementasikan dengan integrasi framework **RASA** dan aplikasi **Flask**, sehingga mampu menjawab pertanyaan mahasiswa sesuai intent yang telah didefinisikan.
2. Hasil evaluasi menggunakan **confusion matrix** dan **classification report** menunjukkan bahwa model mampu mengklasifikasikan intent dengan **akurasi total 100%**, precision rata-rata **0.99**, recall **0.99**, dan f1-score **0.99**. Meskipun demikian, terdapat kesalahan minor pada intent tertentu seperti *informasi_pendaftaran* dan *chit_chat* yang masih bisa ditingkatkan melalui proses retraining dan penyeimbangan data.
3. Hasil pengujian keamanan mengidentifikasi beberapa kerentanan dengan tingkat risiko **rendah hingga sedang**, di antaranya *Content Security Policy (CSP) Header Not Set*, *Absence of Anti-CSRF Tokens*, serta *Cross-Domain Misconfiguration*. Kerentanan ini dapat diatasi dengan menambahkan **security header**, **CSRF middleware**, serta pembatasan **CORS domain** yang diizinkan.
4. Hasil survei **System Usability Scale (SUS)** yang melibatkan mahasiswa dan staf akademik memperoleh skor rata-rata **70,46** yang masuk kategori **Good (B)**. Hal ini menunjukkan bahwa sistem chatbot memiliki tingkat **usability** yang baik dari sisi kemudahan penggunaan, kejelasan interaksi, serta kepuasan pengguna akhir.

5.2 SARAN

Adapun saran untuk penelitian ini dan penelitian selanjutnya adalah sebagai berikut:

1. Melakukan retraining model NLP secara berkala dengan menambahkan dataset terbaru agar akurasi intent tetap tinggi meskipun muncul variasi pertanyaan baru.
2. Memperkuat keamanan aplikasi web melalui penerapan Content Security Policy (CSP), Anti-CSRF Tokens, X-Content-Type-Options header, serta pembatasan domain pada konfigurasi CORS.
3. Mengembangkan fitur context awareness pada chatbot agar percakapan dapat mempertahankan konteks antar pertanyaan sehingga interaksi lebih alami.
4. Memperluas cakupan layanan chatbot ke informasi akademik lain seperti pengajuan beasiswa, informasi magang, jadwal ujian, dan layanan administratif lainnya.
5. Melakukan pengujian usability secara berkala menggunakan System Usability Scale (SUS) atau metode lain untuk memantau dan meningkatkan pengalaman pengguna.

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