

DAFTAR ISI

| | |
|--|------|
| KATA PENGANTAR | iii |
| DAFTAR ISI..... | v |
| DAFTAR GAMBAR | ix |
| DAFTAR TABEL..... | xi |
| DAFTAR SIMBOL..... | xiii |
| DAFTAR LAMPIRAN..... | xvii |
| BAB 1 | 1 |
| PENDAHULUAN | 1 |
| 1.1 Latar Belakang | 1 |
| 1.2 Rumusan Masalah | 2 |
| 1.3 Maksud dan Tujuan | 2 |
| 1.4 Batasan Masalah..... | 2 |
| 1.5 Metode Penelitian..... | 3 |
| 1.5.1 Tahap Pengumpulan Data..... | 3 |
| 1.5.2 Tahap Analisis..... | 4 |
| 1.5.3 Tahap Pembangunan Perangkat Lunak..... | 4 |
| 1.5.4 Tahap Pengujian..... | 6 |
| 1.5.5 Tahap kesimpulan | 6 |
| 1.6 Sistematika Penulisan..... | 6 |
| BAB 2 | 8 |
| LANDASAN TEORI..... | 8 |
| 2.1 Optical Character Recognition (OCR) | 8 |
| 2.2 <i>Library Tesseract</i> | 8 |
| 2.3 <i>Image Processing</i> | 9 |
| 2.3.1 Grayscaleing..... | 9 |
| 2.3.2 Thresholding | 10 |
| 2.3.3 Maximally Stable Extremal Regions (MSER) | 10 |
| 2.4 Citra | 12 |
| 2.4.1 Citra Analog..... | 12 |
| 2.4.2 Citra Digital..... | 12 |

| | | |
|--------------------------|--|----|
| 2.5 | Pengolahan Citra | 12 |
| 2.6 | Segmentasi..... | 13 |
| 2.6.1 | Segmentasi Baris | 13 |
| 2.6.2 | Segmentasi Karakter | 13 |
| 2.7 | Profile Projection..... | 13 |
| 2.8 | Resize | 15 |
| 2.9 | Ekstraksi Fitur | 15 |
| 2.9.1 | Regionprops | 16 |
| 2.10 | Klasifikasi | 17 |
| 2.10.1 | Learning Vector Quantization | 17 |
| 2.11 | Sertifikat..... | 24 |
| 2.12 | Unified Modelling Language (UML) | 24 |
| 2.12.1 | Use Case Diagram | 24 |
| 2.12.2 | Activity Diagram..... | 25 |
| 2.12.3 | Class Diagram | 26 |
| 2.12.4 | Sequence Diagram | 27 |
| 2.13 | MATLAB..... | 28 |
| 2.14 | Pengujian Akurasi..... | 29 |
| BAB 3 | | 31 |
| ANALISIS DAN PERANCANGAN | | 31 |
| 3.1 | Analisis Masalah | 31 |
| 3.2 | Analisis Sistem | 32 |
| 3.3 | Analisis Data Masukan..... | 34 |
| 3.3.1 | Data Latih | 34 |
| 3.3.2 | Data Uji..... | 35 |
| 3.4 | Analisis Metode..... | 36 |
| 3.4.1 | Cropping | 36 |
| 3.4.2 | Grayscale | 37 |
| 3.4.3 | Maximally Stable External Region (MSER) | 40 |
| 3.4.4 | Segmentasi | 49 |
| 3.4.5 | Resize..... | 51 |
| 3.4.6 | Ekstraksi Fitur..... | 52 |
| 3.4.7 | Klasifikasi Learning Vector Quantization 3 (LVQ 3) | 55 |

| | | |
|-----------|--|----|
| 3.5 | Analisis Kebutuhan Non-Fungsional | 61 |
| 3.5.1 | Analisis Kebutuhan Perangkat Keras | 61 |
| 3.5.2 | Analisis Kebutuhan Perangkat Lunak..... | 61 |
| 3.6 | Analisis Kebutuhan Fungsional..... | 62 |
| 3.6.1 | <i>Use Case</i> Diagram | 62 |
| 3.6.1.1 | Deskripsi <i>Use Case</i> Diagram | 63 |
| 3.6.1.2 | Skenario <i>Use Case</i> | 65 |
| 3.6.1.2.1 | Skenario <i>Use Case</i> Form Utama..... | 65 |
| 3.6.1.2.2 | Skenario <i>Use Case</i> Menginput Citra Sertifikat..... | 66 |
| 3.6.1.2.3 | Skenario <i>Use Case Cropping</i> Citra Sertifikat | 67 |
| 3.6.1.2.4 | Skenario <i>Use Case Preprocessing</i> Citra Sertifikat | 68 |
| 3.6.1.2.5 | Skenario <i>Use Case</i> Training..... | 69 |
| 3.6.1.2.6 | Skenario <i>Use Case</i> Pengenalan OCR..... | 70 |
| 3.6.1.2.7 | Skenario <i>Use Case</i> Form Pelatihan | 71 |
| 3.6.1.2.8 | Skenario <i>Use Case</i> Menginput Citra Karakter | 72 |
| 3.6.1.2.9 | Skenario <i>Use Case Preprocessing</i> Citra Karakter | 72 |
| 3.6.2 | Activity Diagram | 74 |
| 3.6.2.1 | Activity Diagram Form Utama | 74 |
| 3.6.2.2 | Activity Diagram Menginput Citra Sertifikat | 75 |
| 3.6.2.3 | Activity Diagram <i>Cropping</i> Citra Sertifikat | 76 |
| 3.6.2.4 | Activity Diagram <i>Preprocessing</i> Citra Sertifikat | 78 |
| 3.6.2.5 | Activity Diagram Training..... | 80 |
| 3.6.2.6 | Activity Diagram Pengenalan OCR..... | 80 |
| 3.6.2.7 | Activity Diagram Form Pelatihan | 82 |
| 3.6.2.8 | Activity Diagram Menginput Citra Karakter | 82 |
| 3.6.2.9 | Activity Diagram Preprocessing Citra Karakter | 83 |
| 3.6.3 | <i>Class</i> Diagram..... | 85 |
| 3.6.4 | <i>Sequence</i> Diagram | 85 |
| 3.6.4.1 | <i>Sequence</i> Diagram Menginput Citra Sertifikat | 86 |
| 3.6.4.2 | <i>Sequence</i> Diagram <i>Cropping</i> Citra Sertifikat | 86 |
| 3.6.4.3 | <i>Sequence</i> Diagram <i>Preprocessing</i> Citra Sertifikat..... | 87 |
| 3.6.4.4 | <i>Sequence</i> Diagram Training Data | 88 |
| 3.6.4.5 | <i>Sequence</i> Diagram Pengenalan OCR..... | 89 |
| 3.6.4.6 | <i>Sequence</i> Diagram Menginput Citra Karakter | 91 |

| | | |
|----------------------------------|---|-----|
| 3.6.4.7 | <i>Sequence Diagram Preprocessing Citra Karakter</i> | 91 |
| 3.7 | Perancangan Sistem..... | 92 |
| 3.7.1 | Perancangan Antarmuka | 93 |
| 3.7.2 | Perancangan Pesan..... | 94 |
| 3.7.3 | Jaringan Smentarik | 94 |
| BAB 4 | | 90 |
| IMPLEMENTASI DAN PENGUJIAN | | 90 |
| 4.1 | Implementasi | 90 |
| 4.1.1 | Implementasi Perangkat Keras | 90 |
| 4.1.2 | Impelementasi Perangkat Lunak..... | 90 |
| 4.1.3 | Implementasi Antarmuka | 91 |
| 4.1.3.1 | Implementasi Form Utama..... | 92 |
| 4.1.3.2 | Implementasi Form Pelatihan | 96 |
| 4.2 | Pengujian Sistem | 98 |
| 4.2.1 | Pengujian <i>Black Box</i> | 98 |
| 4.2.1.1 | Rencana Pengujian Sistem | 98 |
| 4.2.1.2 | Hasil Pengujian Sistem | 99 |
| 4.2.2 | Pengujian Akurasi..... | 101 |
| 4.2.2.1 | Pengujian Akurasi Data Latih Karakter | 102 |
| 4.2.2.2 | Pengujian Akurasi Pengenalan Karakter Citra Sertifikat..... | 105 |
| 4.3 | Evaluasi Pengujian | 106 |
| 4.3.1 | Evaluasi Pengujian <i>Black Box</i> | 106 |
| 4.3.2 | Evaluasi Pengujian Akurasi..... | 106 |
| BAB 5 | | 113 |
| KESIMPULAN DAN SARAN..... | | 113 |
| 5.1 | Kesimpulan..... | 113 |
| 5.2 | Saran | 113 |
| DAFTAR PUSTAKA | | 114 |