LAMPIRAN

Lampiran 1 Surat Izin Penelitian

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Program Studi
Teknik Informatika
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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Nomor : 056-009/KET/FST.1/A/2024
Lampiran : -
Perihal : **Keterangan Melakukan Penelitian**

Assalamu'alaikum Warrahmatullahi Wabarrakatuh

Puji Syukur kepada Allah Subhanahu wa ta'ala yang senantiasa melimpahkan Rahmat-Nya kepada kita sekalian. Amin.

Dengan surat ini, kami menerangkan bahwa mahasiswa berikut:

No	Nama	NIM
1	Amelda Auniyah	1911102441019
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Melakukan penelitian dengan citra digital menggunakan algoritma kriptografi kunci publik.

Demikian hal ini disampaikan, atas kerjasamanya kami ucapkan terima kasih.

Wassalamu'alaikum Warrahmatullahi Wabarrakatuh

Samarinda, 28 Dzulhijjah 1445 H
5 Juli 2024 M

Ketua Program Studi S1 Teknik Informatika

Arbansyah, S.Kom., M.TI
NIDN. 1118019203

Lampiran 2 Citra Digital

Lampiran 3 Kartu Kendali Bimbingan

KARTU KENDALI BIMBINGAN LAPORAN SKRIPSI

Nama Mahasiswa : Amelda Auniyah

NIM : 1911102441019

Nama Dosen Pembimbing : Sayekti Harits Suryawan, S.kom., M.Kom.

Judul Penelitian : PENERAPAN ALGORITMA *RSA* PADA CITRA DIGITAL

No	Tanggal	Uraian Pembimbingan	Paraf Dosen
1	7/03/2024	Membahas alur-alur penulisan pada bab1 dan metode yang digunakan	
2	24/04/2024	Membahas untuk latar belakang, rumusan masalah, tujuan penelitian, dan manfaat penelitian.	
3	05/05/2024	Memperbaiki di latar belakang bagian penelitian sebelumnya (Alfaozi, 2021	
4	07/05/2024	Membahas penjelasan pada isi dari bab 2 metode penelitian	
5	08/05/2024	Perbaikan diagram pada bab 2 dan menjelaskan isi diagram tersebut	
6	10/05/2024	Perbaikan proposal pada bab 2 pada penjelasan diagram	
7	13/05/2024	Revisi penjelasan dan pembahasan untuk memproses coding	
8	15/05/2024	Acc proposal pada bab1 dan bab 2 untuk riview desk	
9	05/06/2024	Menambahkan entropi pada bab 2 dan revisian proposal setelah selesai review desk	
10	26/06/2024	Pembahasan coding untuk bab 3 dan penyusunan	
11	28/06/2024	Memperbaiki coding untuk penerapan algoritma	

Dosen Pembim bing

(Sayekti Harits Suryawan, S.kom., M.Kom)
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Ketua Program Studi

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Lampiran 4 Seluruh Coding Python

```python
# Fungsi Extended Euclidean Algorithm
def extended_gcd(a, b):
    if a == 0:
        return b, 0, 1
    g, x1, y1 = extended_gcd(b % a, a)
    x = y1 - (b // a) * x1
    y = x1
    return g, x, y

# Fungsi untuk menghasilkan kunci publik dan privat RSA
def generate_rsa_keys():
    p = sympy.randprime(11, 20)
    q = sympy.randprime(11, 20)
    while p == q:
        q = sympy.randprime(11, 20)

    n = p * q
    phi = (p - 1) * (q - 1)
```

```python
    e = random.randrange(2, phi)
    g = sympy.gcd(e, phi)
    while g != 1:
        e = random.randrange(2, phi)
        g = sympy.gcd(e, phi)

    d = mod_inverse(e, phi)

    public_key = (e, n)
    private_key = (d, n)

    return public_key, private_key

# Fungsi untuk enkripsi pesan menggunakan RSA
def rsa_encrypt(message, public_key):
    e, n = public_key
    cipher = pow(message, e, n)
    return cipher
```

```python
# Fungsi untuk dekripsi pesan menggunakan RSA
def rsa_decrypt(cipher, private_key):
    d, n = private_key
    message = pow(cipher, d, n)
    return message

# Fungsi untuk menghitung entropi dari distribusi nilai piksel dalam gambar
def calculate_entropy(image):
    pixels = np.array(image)
    histogram, _ = np.histogram(pixels, bins=256, range=(0, 256))
    histogram = histogram.astype(float) / pixels.size
    histogram = histogram[histogram != 0]
    entropy = -np.sum(histogram * np.log2(histogram))
    return entropy
```

```python
# Fungsi untuk mengacak gambar
def scramble_image(image):
    random.seed(1234)  # Seed untuk hasil yang deterministik
    pixels = image.load()
    width, height = image.size
    scramble_map = {}

    for x in range(width):
        for y in range(height):
            r, g, b = pixels[x, y]
            r_scrambled = (r + random.randint(0, 255)) % 256
            g_scrambled = (g + random.randint(0, 255)) % 256
            b_scrambled = (b + random.randint(0, 255)) % 256
            pixels[x, y] = (r_scrambled, g_scrambled, b_scrambled)
            scramble_map[(x, y)] = (r_scrambled - r, g_scrambled - g, b_scrambled - b)

    return image, scramble_map
```

```python
# Fungsi untuk mengembalikan pengacakan gambar
def unscramble_image(image, scramble_map):
    pixels = image.load()
    width, height = image.size

    for x in range(width):
        for y in range(height):
            r, g, b = pixels[x, y]
            r_diff, g_diff, b_diff = scramble_map[(x, y)]
            r_unscrambled = (r - r_diff) % 256
            g_unscrambled = (g - g_diff) % 256
            b_unscrambled = (b - b_diff) % 256
            pixels[x, y] = (r_unscrambled, g_unscrambled, b_unscrambled)

    return image
```

```python
# Function for image data extraction
def extract_image_data(image):
    image_data = {
        "Ukuran": image.size,
        "Mode Warna": image.mode,
        "Format": image.format,
    }
    return image_data

# Fuction to upload image
def upload_and_process_image():
    upload = FileUpload(accept='image/*', multiple=False)
    container = VBox([upload])

    def on_upload_change(change):
        for filename, file_info in upload.value.items():
            img = Image.open(BytesIO(file_info['content']))
            display(img)

            # Ekstraksi data gambar
            image_data = extract_image_data(img)
            print("Data Gambar:", image_data)
```


```python
            # Ekstraksi data gambar
            image_data = extract_image_data(img)
            print("Data Gambar:", image_data)
```


```python
            # Generate RSA keys
            public_key, private_key = generate_rsa_keys()
            print('Public Key:', public_key)
            print('Private Key:', private_key)

            # Hitung entropi gambar asli
            original_entropy = calculate_entropy(img)
            print(f'Original Image Entropy: {original_entropy:.2f}')

            # Scramble image
            print('Scrambling image...')
            scrambled_img, scramble_map = scramble_image(img.copy())
            display(scrambled_img)

            # Hitung entropi gambar setelah diacak
            scrambled_entropy = calculate_entropy(scrambled_img)
            print(f'Scrambled Image Entropy: {scrambled_entropy:.2f}')
```

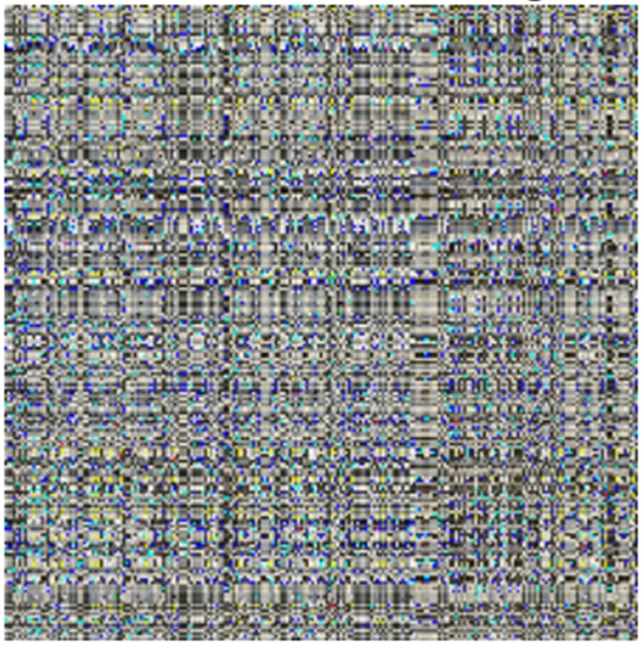

```python
            # Hitung entropi gambar setelah diacak
            scrambled_entropy = calculate_entropy(scrambled_img)
            print(f'Scrambled Image Entropy: {scrambled_entropy:.2f}')
```


```python
            # Encrypt scrambled image
            print('Encrypting image...')
            encrypted_img = scrambled_img.copy()
            pixels = encrypted_img.load()
            width, height = encrypted_img.size

            for x in range(width):
                for y in range(height):
                    r, g, b = pixels[x, y]
                    r_encrypted = rsa_encrypt(r, public_key) % 256
                    g_encrypted = rsa_encrypt(g, public_key) % 256
                    b_encrypted = rsa_encrypt(b, public_key) % 256
                    pixels[x, y] = (r_encrypted, g_encrypted, b_encrypted)

            display(encrypted_img)

            # Hitung entropi gambar setelah enkripsi
            encrypted_entropy = calculate_entropy(encrypted_img)
            print(f'Encrypted Image Entropy: {encrypted_entropy:.2f}')
```

```python
            # Decrypt encrypted image
            print('Decrypting image...')
            decrypted_img = encrypted_img.copy()
            pixels = decrypted_img.load()

            for x in range(width):
                for y in range(height):
                    r_encrypted, g_encrypted, b_encrypted = pixels[x, y]
                    r_decrypted = rsa_decrypt(r_encrypted, private_key) % 256
                    g_decrypted = rsa_decrypt(g_encrypted, private_key) % 256
                    b_decrypted = rsa_decrypt(b_encrypted, private_key) % 256
                    pixels[x, y] = (r_decrypted, g_decrypted, b_decrypted)

            display(decrypted_img)

            # Hitung entropi gambar setelah dekripsi
            decrypted_entropy = calculate_entropy(decrypted_img)
            print(f'Decrypted Image Entropy: {decrypted_entropy:.2f}')

            # Unscramble decrypted image
            print('Unscrambling image...')
            unscrambled_img = unscramble_image(decrypted_img.copy(), scramble_map)
            display(unscrambled_img)
```

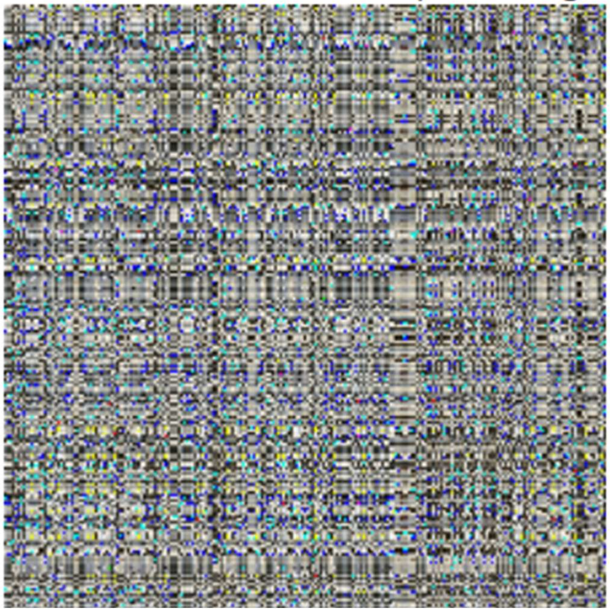
```python
            # Hitung entropi gambar setelah unscrambling
            unscrambled_entropy = calculate_entropy(unscrambled_img)
            print(f'Unscrambled Image Entropy: {unscrambled_entropy:.2f}')

            # Pastikan entropi setelah unscrambling sama dengan entropi asli
            if np.isclose(original_entropy, unscrambled_entropy, atol=0.01):
                print('Entropy check passed: The entropies are close enough.')
            else:
                print('Entropy check failed: The entropies differ.')

    upload.observe(on_upload_change, names='value')
    display(container)

print('Upload an image to scramble and encrypt using RSA:')
upload_and_process_image()
```

Gambar setelah scrambling:



Encrypting image...

Gambar setelah dekripsi dengan RSA:



Gambar setelah unscrambling: