

errors/bugs

Level 1 – Compile-time Errors

Bug 1 – Missing Eigen include

Symptom:

IntelliSense / compiler error: `fatal error: Eigen/Dense: No such file or directory.`

Root cause:

Eigen is not a standard C++ header. It must be installed and included properly.

Fix:

- Install Eigen (`sudo pacman -S eigen`) and include with:
`#include <Eigen/Dense>`
- Also add `/usr/include/eigen3` to the include path.

Bug 2 – Wrong stream operator

Symptom:

`error: no match for 'operator<' ...` when using `cout < "...".`

Root cause:

Used `<` instead of `<<` for C++ output.

Fix:

```
cout << "Hello" << endl;
```

Reasoning:

The `<<` operator is overloaded for output streams; `<` is just comparison.

Bug 3 – Wrong Eigen namespace**Symptom:**

error: 'Vector3d' in namespace 'Eigen' does not name a type.

Root cause:

Used `Eigen: Vector3d` (single colon) instead of `Eigen::Vector3d`.

Fix:

```
Eigen::Vector3d v(1,2,3);
```

Reasoning:

In C++, namespaces use `::`, not `..`.

Also the same problem in CMakeLists.txt so I won't mention it separately.

Bug 4 – Malformed rotation matrix assignment**Symptom:**

Compiler errors: “no match for operator<” because of
`rotation < cos(angle), sin(angle), 0, ...`

Root cause:

Used `<` instead of Eigen's comma initializer `<<`.

Fix:

```
rotation << cos(angle), -sin(angle), 0,  
            sin(angle),  cos(angle), 0,  
            0,           0,           1;
```

Reasoning:

Eigen uses `<<` to fill matrices row-by-row.

Bug 5 – Stray code / invalid comment**Symptom:**

- A stray line `CMakeList BUG` broke compilation.
- Comment written as `/ 45 degrees` (invalid).

Root cause:

Leftover placeholder text and malformed comment syntax.

Fix:

- Removed `CMakeList BUG`.

Correct comment style:

```
// 45 degrees
```

Reasoning:

Compiler treats stray text as unknown identifiers;
comments must start with `//` or `/* ... */`.

Level 2 – Logic Errors

Bug 6 – Wrong rotation matrix signs

Symptom:

Rotated vector produced incorrect results.

Root cause:

The signs of `sin` terms were swapped:

`cos, sin`

`-sin, cos`

- That is actually a clockwise rotation (or inconsistent).

Fix:

Used correct CCW rotation matrix in XY plane:

`[cos -sin 0]`

`[sin cos 0]`

`[0 0 1]`

Reasoning:

Standard 2D rotation formula:

`x' = cosθ · x - sinθ · y,`

`y' = sinθ · x + cosθ · y.`

Bug 7 – Partial decode of array

Symptom:

Output was truncated: "`Amin`" instead of "`Amin is`".

Root cause:

Called `decodeMessage(simple_values, 4)` but array

has 7 elements.

Fix:

```
int length = sizeof(simple_values) /
sizeof(simple_values[0]);

cout << decodeMessage(simple_values,
length) << endl;
```

Reasoning:

Function must process the full length; using 4 ignored the rest.

Level 3 – Algorithmic / Behavioural Issues

Bug 8 – Unstable ASCII decoding after rotation

Symptom:

After rotation, results became non-printable characters.

Root cause:

Rotation mixes values; rounding them may produce invalid ASCII.

Fix:

```
double scl = 0.5;
```

```
Eigen::Matrix3d rotation;
```

```
rotation <<    cos(angle)-scl,    -sin(angle),    0,
               sin(angle),      cos(angle)-scl,    0,
               0,                0, 1-scl;
```

Reasoning:

$$(A\text{-Scaling})X=0$$

Since $X \neq 0$ then a-scaling = 0

Resources:

<https://www.youtube.com/watch?v=t91ZgQa7Rus>