

Package ‘MarineChain’

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Type Package

Title Blockchain-Enabled Maritime Transportation System Simulator

Version 1.1.0

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Description Simulates Blockchain-Enabled Maritime Transportation Systems (BMTS) by integrating asynchronous, great-circle vessel kinematics with decentralised edge-computing consensus layers. The package provides a fully self-contained cyber-range running completely offline, permitting the risk-free injection of spatial and telemetry threat vectors (e.g., geofence breaches, coordinate modification, and node impersonation). It includes an interactive workspace engine built using 'shinydashboard' and 'leaflet' map layers for monitoring vessel states and ledger updates. Implemented consensus structures are modeled on a lightweight Proof-of-Authentication framework optimized for resource-constrained distributed nodes.

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Encoding UTF-8

Imports shiny, shinydashboard, digest, leaflet, plotly

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

RoxygenNote 7.3.3

Config/testthat/edition 3

URL <https://github.com/ikemillar/MarineChain>

BugReports <https://github.com/ikemillar/MarineChain/issues>

NeedsCompilation no

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Contents

app_server	2
app_ui	2
calc_distance	3
inject_attack	3
run_app	4
simulate_crypto_ops	4
simulate_network_routing	5
simulate_poah_block	5

Index	6
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app_server	<i>The Application Server Logic</i>
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Description

The Application Server Logic

Usage

app_server(input, output, session)

Arguments

- | | |
|---------|--|
| input | The Shiny input binding element list array mapping object. |
| output | The Shiny output rendering layout UI element structure list. |
| session | The active user environment session context container runtime. |

Value

No return value, called for application runtime side effects.

app_ui	<i>The Application User Interface</i>
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Description

The Application User Interface

Usage

app_ui(request)

Arguments

request The Shiny request object parameter environmental state.

Value

A Shiny UI object representing the dashboard structural layout.

calc_distance	<i>Calculate Geodetic Distance (Haversine Formula)</i>
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Description

Calculate Geodetic Distance (Haversine Formula)

Usage

```
calc_distance(lat1, lng1, lat2, lng2)
```

Arguments

lat1, lng1 Latitude and Longitude of Node 1
lat2, lng2 Latitude and Longitude of Node 2

Value

Distance in kilometers

inject_attack	<i>Inject Malicious Attacks into Maritime Telemetry Streams</i>
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Description

Inject Malicious Attacks into Maritime Telemetry Streams

Usage

```
inject_attack(clean_packet, attack_type)
```

Arguments

clean_packet A list containing data, signature, and metadata from a vessel
attack_type Character. One of "None", "Replay", "Modification", "Impersonation"

Value

A modified packet structure representing an intercepted/compromised transmission

run_app	<i>Run the MarineChain Simulation Application</i>
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Description

Launches the interactive, self-contained Shiny dashboard sandbox.

Usage

```
run_app(...)
```

Arguments

... Optional arguments passed directly to the `shiny::shinyApp` execution loop.

Value

No return value, called to launch the interactive web application interface side effects.

Examples

```
# Only run execution loops in interactive R sessions
if (interactive()) {
  run_app()
}
```

simulate_crypto_ops	<i>Simulate Cryptographic Processing Overhead</i>
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Description

Simulate Cryptographic Processing Overhead

Usage

```
simulate_crypto_ops(data_size_kb, operation)
```

Arguments

`data_size_kb` Numeric. Size of the sensor telemetry data in Kilobytes.
`operation` Character. The step to simulate ("encrypt", "sign", "verify", "decrypt").

Value

A list containing processing time (ms) and output data size (kb).

`simulate_network_routing`*Simulate Multi-Hop Maritime Network Routing*

Description

Simulate Multi-Hop Maritime Network Routing

Usage

```
simulate_network_routing(vessel_coord, cs_coord, haps_coord, payload_size_kb)
```

Arguments

<code>vessel_coord</code>	Vector of c(lat, lng) for the vessel
<code>cs_coord</code>	Vector of c(lat, lng) for the Control Station
<code>haps_coord</code>	Vector of c(lat, lng) for the nearest HAPS platform
<code>payload_size_kb</code>	Numeric size of the telemetry packet

Value

A list detailing routing path, hop count, and transmission latency

`simulate_poah_block`*Simulate PoAH Blockchain Block Generation*

Description

Simulate PoAH Blockchain Block Generation

Usage

```
simulate_poah_block(dynamic_ledger, incoming_txs)
```

Arguments

<code>dynamic_ledger</code>	A list representing the current blockchain ledger
<code>incoming_txs</code>	A list of verified vessel data payloads to combine into a block

Value

An updated ledger list containing the new block

Index

app_server, [2](#)

app_ui, [2](#)

calc_distance, [3](#)

inject_attack, [3](#)

run_app, [4](#)

simulate_crypto_ops, [4](#)

simulate_network_routing, [5](#)

simulate_poah_block, [5](#)