Golden Jubilee Celebration
BCSIR Congress-2023
08-10 March 2024
Theme: Smart Bangladesh of Tomorrow is the Science of Today
Bangladesh Council of Scientific and Industrial Research (BCSIR)

PP-888

Vision for Smart Bangladesh: A Study on Ship Collision Avoidance Algorithms

Dr. Zobair Ibn Awal[1] and Tasmim Hossain Samyo[2]

[1] Professor, Bangladesh University of Engineering and Technology (BUET), Email: zobair@name.buet.ac.bd Phone: 01779021091

[2] Student, Bangabandhu Sheikh Mujibur Rahman Maritime University (BSMRMU), Bangladesh, Email: tasmimhossainsamyo@gmail.com Phone: 01708940990
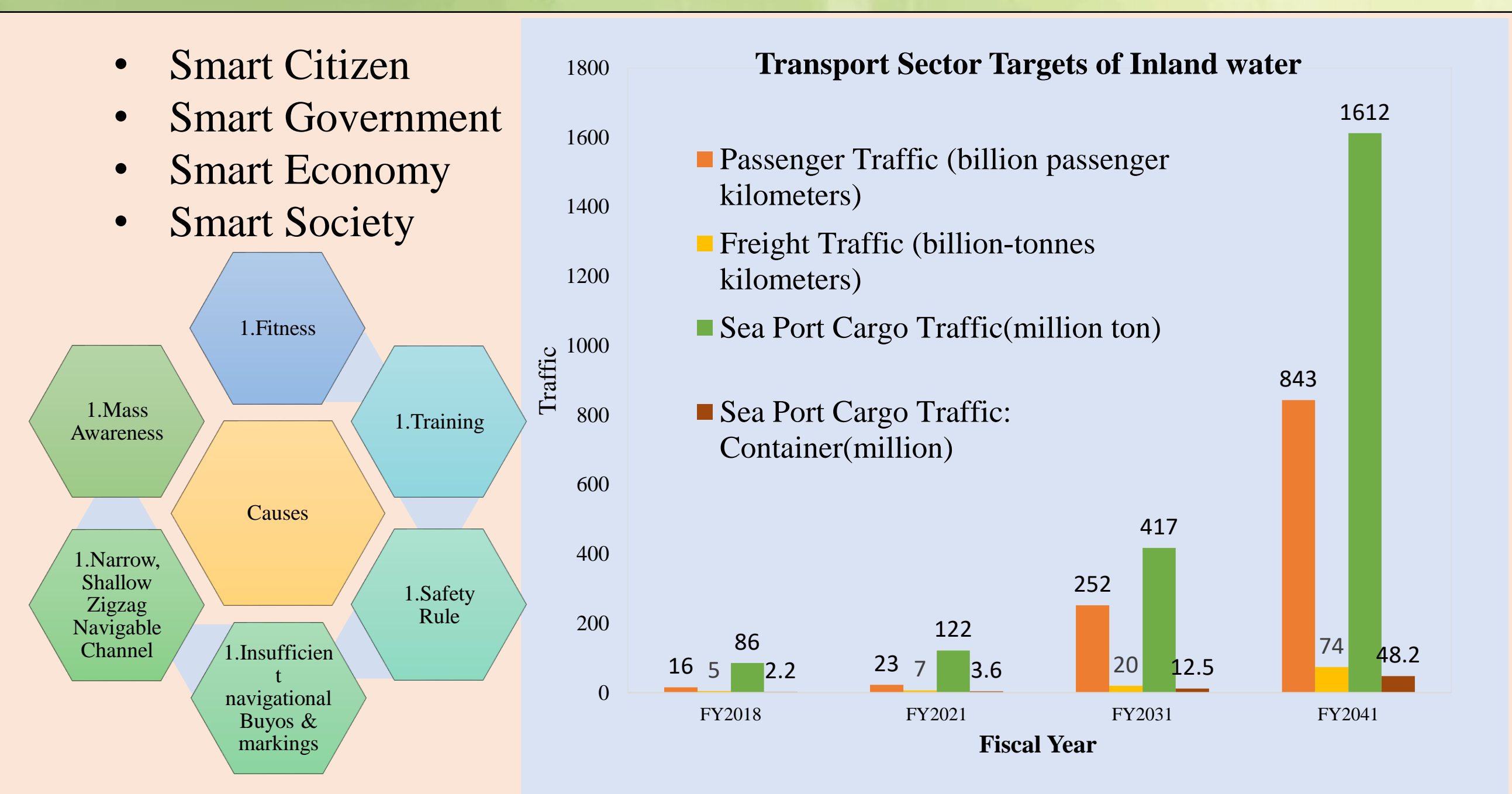
Abstract

The Smart Bangladesh Vision 2041 aims to transform Bangladesh from a densely populated country to an intelligent, developed, equitable, and high-income nation by 2041. This transformation is crucial for fostering digitally equipped citizens and addressing population growth. Bangladesh's shipping industry needs development in intelligent technologies like robotics, Artificial Intelligence, Big Data, Virtual Reality, the Internet of Things, and Autonomous Ships. The Perspective Plan for Smart Bangladesh raises the bar on improving river transport safety and developing smart riverport infrastructure. Automation technology can improve productivity and service efficiency to meet future traffic demand. Considering smart Bangladesh, movements in the inland water transportation system are expected to increase. So, for Bangladesh's economic growth, there must be a reduction in accidents in water transport. Many accidents occur due to ship collisions, and they must be avoided. Ship collision avoidance is crucial for building a Smart Infrastructure and fostering economic growth. This paper will investigate ship collision avoidance algorithms that can be applied to autonomous ships. Such techniques can also assist human operators to predict and avoid eminent ship collisions.

Motivation

By 2041, Bangladesh is expected to have evolved from a densely populated nation to an intelligent, developed, equitable and high-income country, according to the 'Smart Bangladesh Vision 2041'.
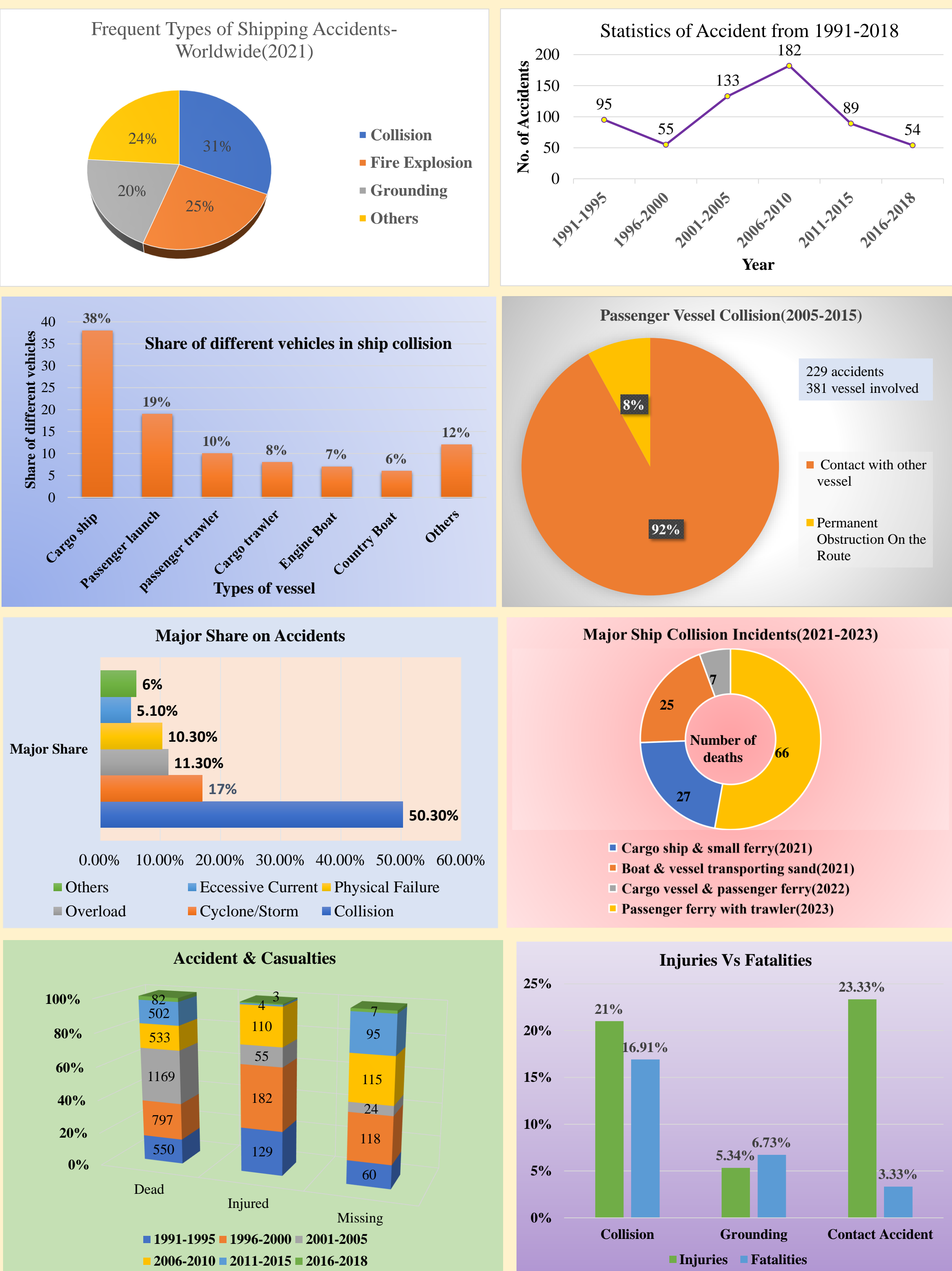- Improve river transport safety.
- Enhance Automation Technology.
- Ensure Ship Collision Avoidance.

Smart Bangladesh & Smart Shipping

- Smart Citizen
- Smart Government
- Smart Economy
- Smart Society

Transport Sector Targets of Inland water

Statistics

More than 3600 people died and nearly 500 went missing in more than 550 accidents in waterways in Bangladesh between 1991 to 2020.

Frequent Types of Shipping Accidents-Worldwide (2021)

Statistics of Accident from 1991-2018

Share of different vehicles in ship collision

Passenger Vessel Collision (2005-2015)

Major Share on Accidents

Major Ship Collision Incidents (2021-2023)

Accident & Casualties
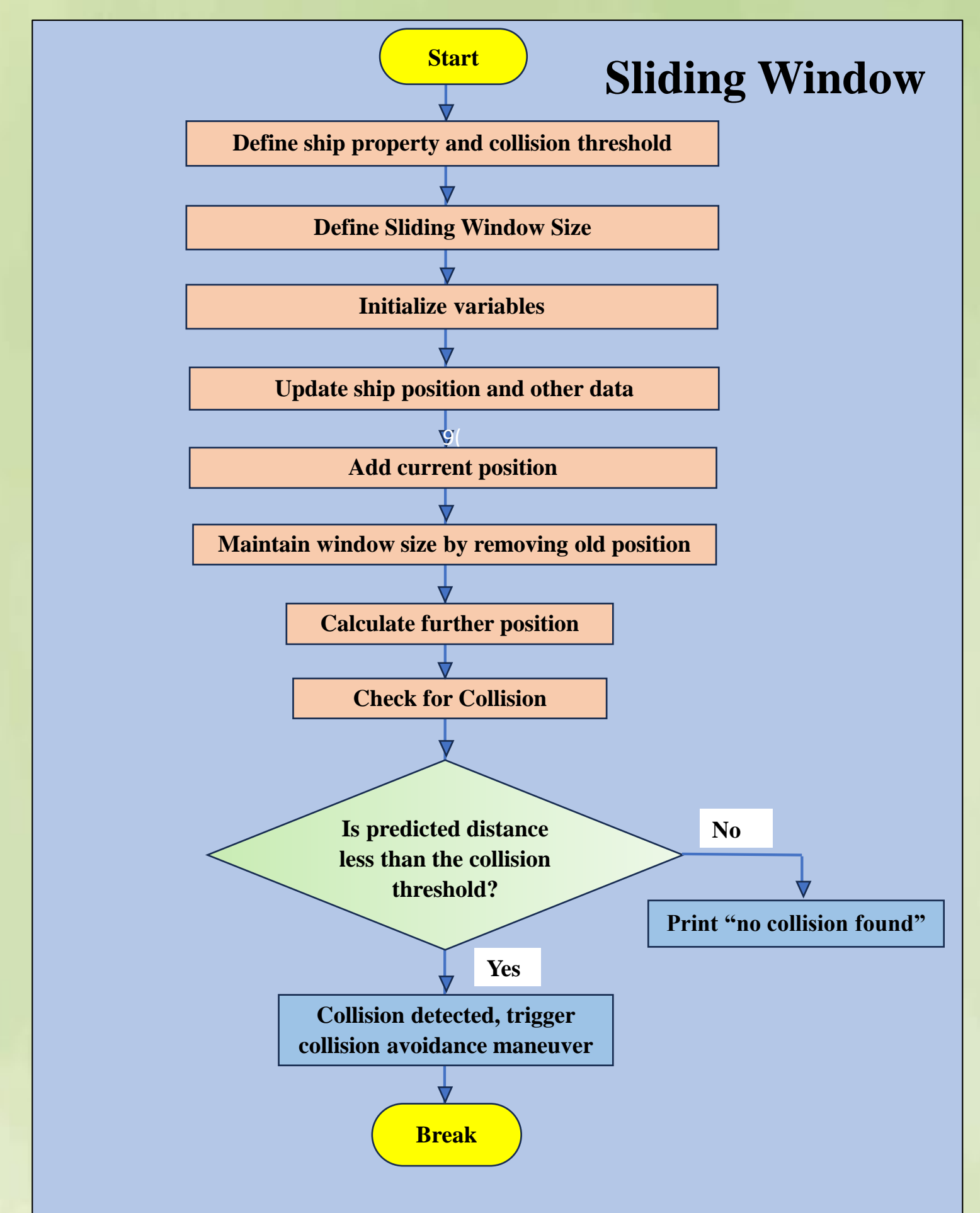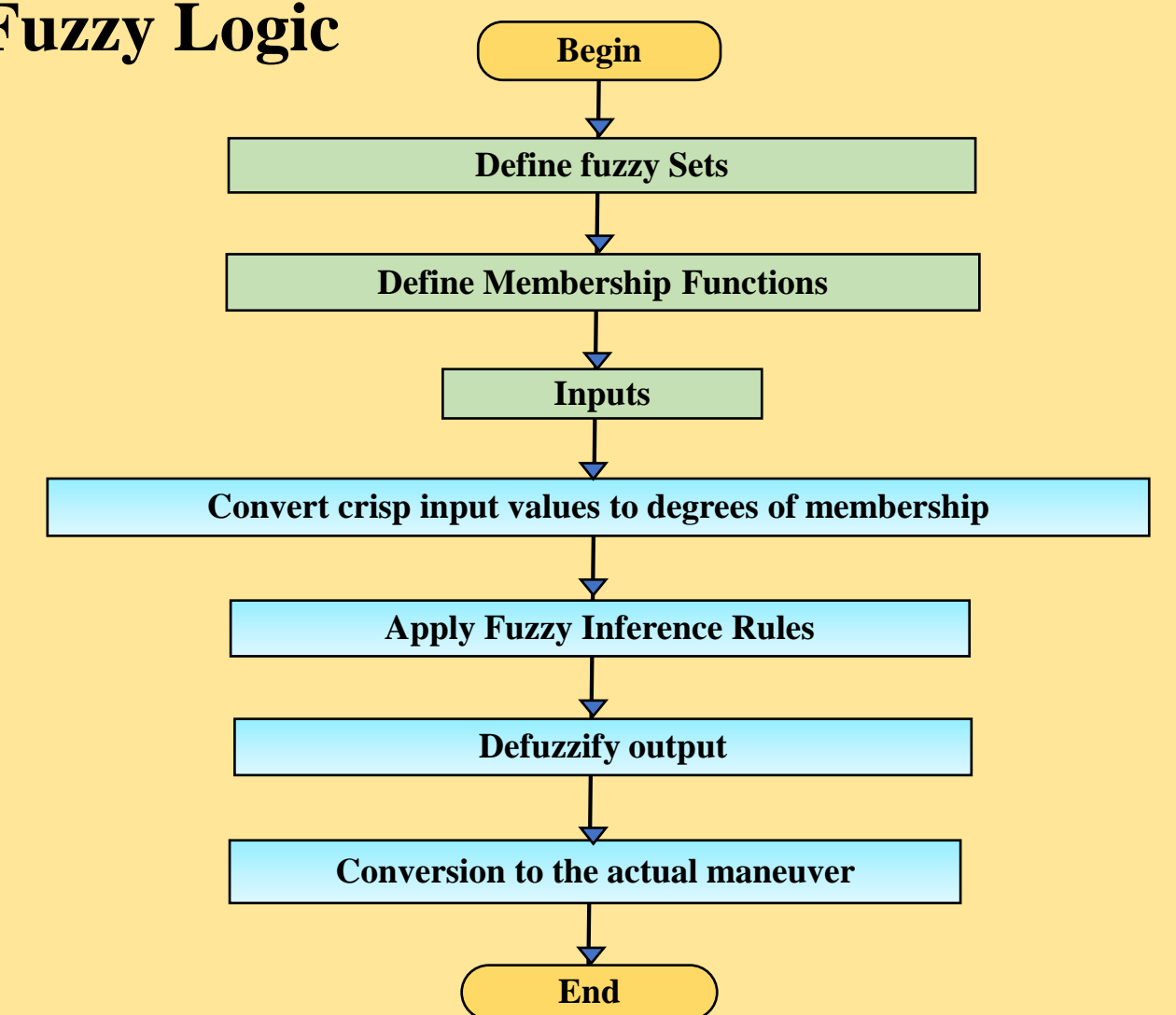

Injuries Vs Fatalities

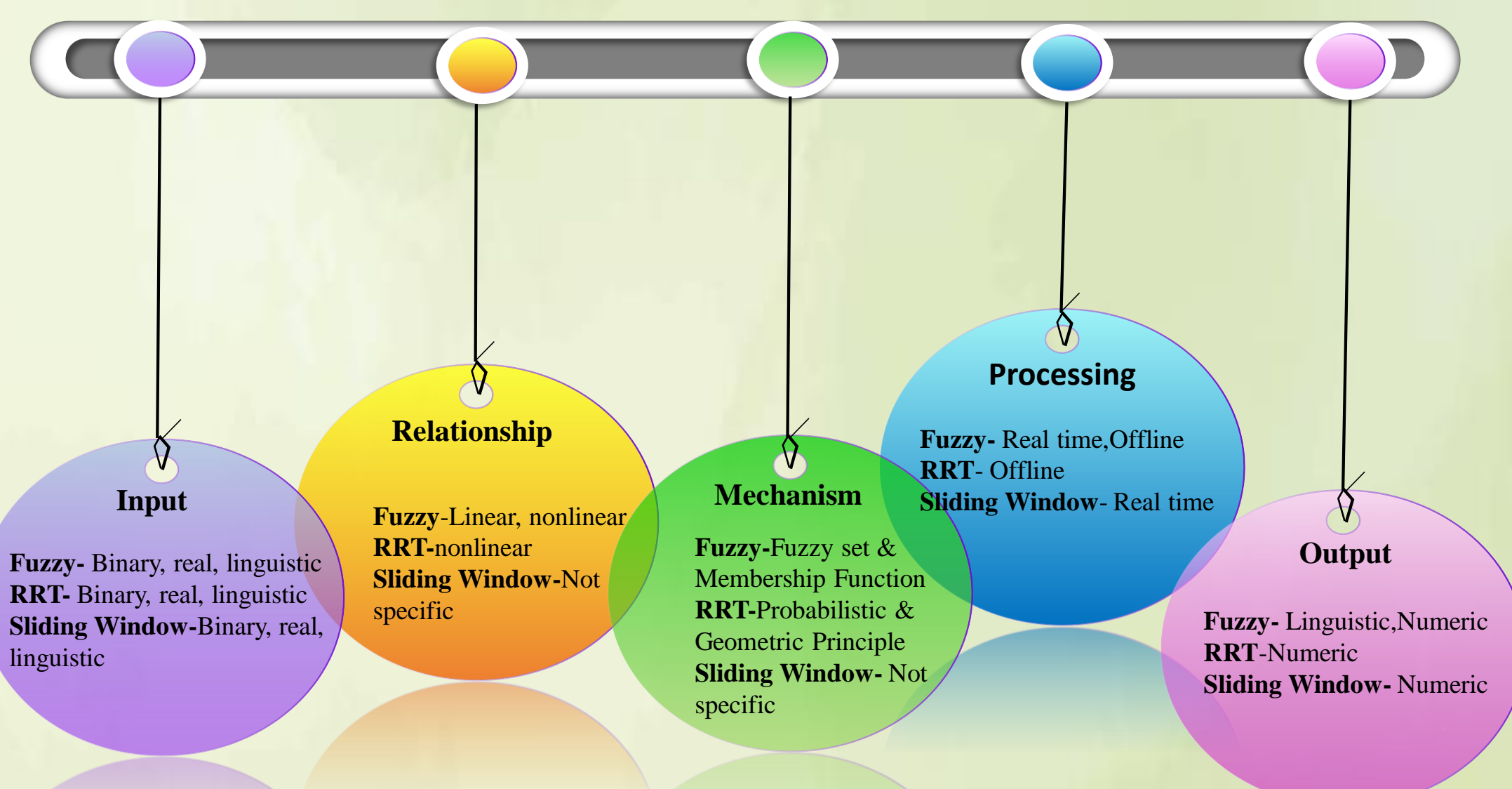## Ship Collision Avoidance Algorithm

- **Fuzzy Logic** - Logical system that is based on degree of truth rather than the classical true or false.
- **RRT** - A sampling-based motion planning algorithm.
- **Sliding Window** - General framework to process data in a sequential manner, focusing on specific segments at a time.

RRT

Fuzzy Logic

Sliding Window
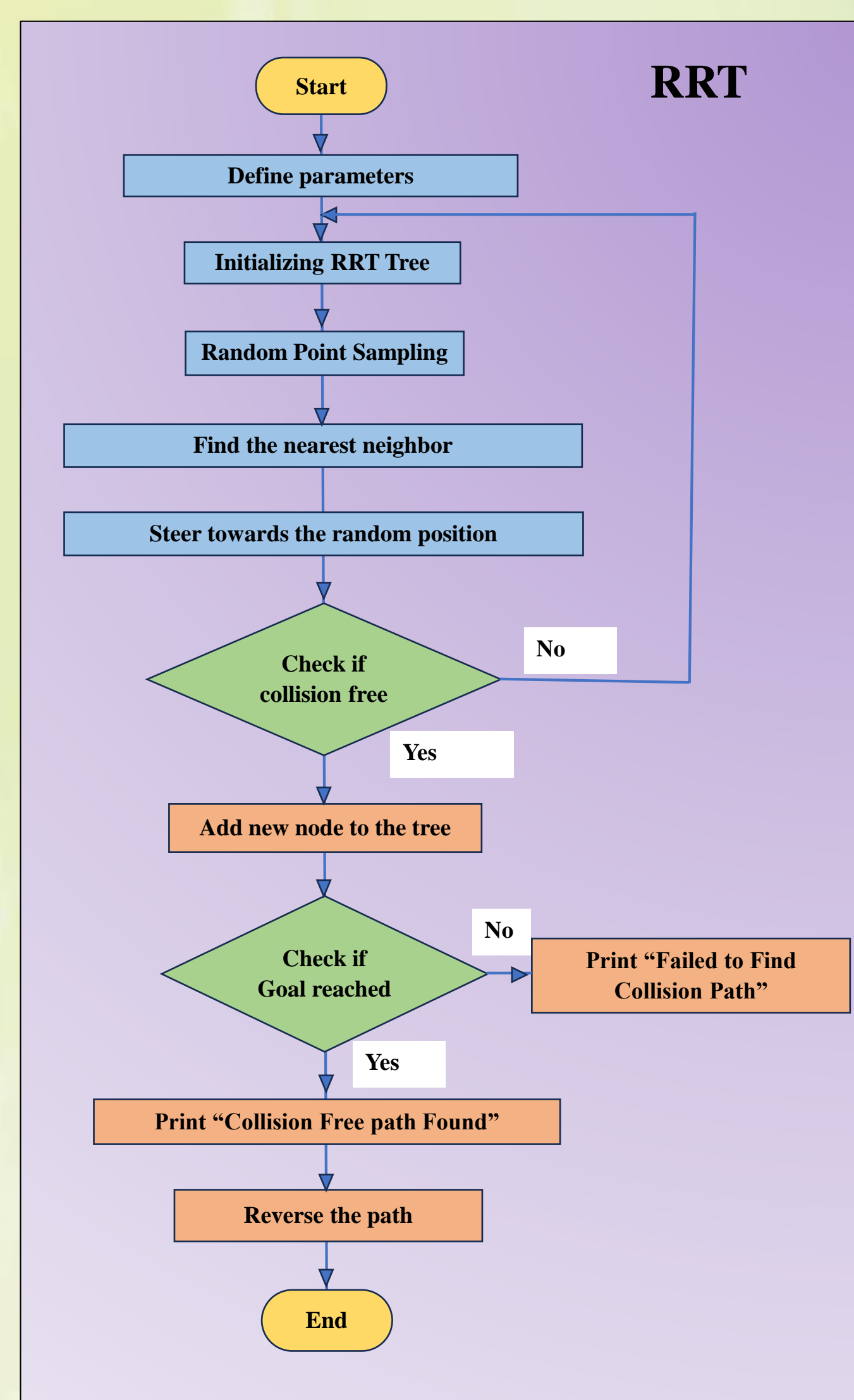
Result

Research Challenges - The algorithms couldn't be tested through computer as modelling 'Man & Machine Interaction' is really difficult.

Recommendation-

- Further research on autonomous ship is highly recommended.
- Research should be conducted on smart onboard ship system, ship control & navigation system such as AIS, Smart Communication Systems, Electronic charts and navigation systems, Decision support systems, Shore-based Monitoring and Control, Software for route optimization, Autonomous collision avoidance systems, Remote Piloting, , Advanced Image Detection Systems etc.

Reference-

Md. Imran Uddin[1], Dr. Zobair Ibn Awal[2], ",An Insight into the Maritime Accident Characteristics in Bangladesh",2017, Yaseen Adnan Ahmed[1], Mohammed Abdul Hannan[2], "COLREGs Compliant Fuzzy-Based Collision Avoidance System for Multiple Ship Encounters", 2021, Raphael Zaccone & Michele Martelli, "A collision avoidance algorithm for ship guidance applications",2019,Raphael Zaccone, Michele Martelli, "A COLREG-Compliant Ship Collision Avoidance Algorithm",2019, H. Rong , A.P. Teixeira, "Ship collision avoidance behaviour recognition and analysis based on AIS data",2022, Zobair Ibn Awal[1], Dr. M. Rafiqul Islam[2], "Marine Vehicle Accident Characteristics in Bangladesh: Study on Collision Type Accidents",2007, Hristos Karahalios , "The contribution of risk management in ship management: The case of ship collision", 2013,Transportation Safety Board of Canada", Muhammad Rabiul Islam Md. Mashiur Rahaman, "Investigation of the Causes of Maritime Accidents in the Inland Waterways of Bangladesh",2015, Mohammad Obaidullah Ibne Bashir, "Domestic Ferry Safety in Bangladesh",Pengfei Chena, Yamin Huanga ,"Probabilistic risk analysis for ship-ship collision: State-of-the-art",2019.