



## **STUDY ON SIGNAL BLOCKING SYSTEM TO PREVENT OVER LOADED PASSENGER VESSEL ENGINE FROM STARTING TO ENSURE MAXIMUM SAFETY**

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### **ABSTRACT**

*This research work is based on the idea to avoid over loading condition of passenger vessel to ensure maximum safety. Overloading of a passenger vessel is very dangerous and it causes unstable condition for a vessel. The work here represents an idea to stop the vessel's engine from getting started in case of overloading. Theories have been discussed to establish the signal blocking idea and a schematic diagram has also been shown in this research work. The results show great promise to establish the system and can be considered as ground breaking idea in the related research field.*

**Keywords:** *Safety, Overloading, Passenger vessel, Signal blocking.*

### **1.0 INTRODUCTION**

Bangladesh is a riverine country and there is almost 700 small and big rivers [1]. These rivers are an easy and comparatively cheaper transportation mode and it is actually the only mode of transportation in some areas of Bangladesh. Being a cheaper option, the inland waterways is popular among the people also for carrying various goods and commodities. Though the total navigable length of inland waterways is near about 5968 km, during dry seasons it reduces to 3600 km. the popularity of inland waterways as an economical transportation mode is increasing day by day and at present there are about ten thousands registered vessels in Bangladesh and this number is increasing too [1]. But at the same time, the number of unregistered vessels is also not negligible and unfortunately the number of unregistered vessels is also growing up than before. In spite of being one of the most popular and common transportation modes, our inland waterways are not completely safe and sound for us. Every year a huge number of people lose their lives and valuable goods or become seriously injured due to the accidents in the inland waterways. These accidents occur due to many reasons including natural disasters, overloading, unstable vessels, and inexperienced sailors and so on. No matter whatever the reason may be behind these accidents, the result is always the same – loss of life and loss of properties which is not desired at all. It is not like that the concerned authority did not take any measure against it but this problem is appearing with new dimension and challenges every day. These new challenges cannot be faced with the old ideas and measures. We need some new ideas and new technology to meet these challenges. In this paper the initial reasons behind the inland waterways accidents are discussed and finally an idea is proposed to overcome the overloading problem.

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## 2.0 DATA COLLECTION

All the data presented in this paper is collected from BIWTA (Bangladesh Inland Water Transport Authority, URL <http://www.biwta.gov.bd/>), BIWTC (Bangladesh Inland Water Transport Corporation) and DOS (Department of Shipping). Some data are collected from pre published journals which are mentioned in the reference section at the end of this paper.

## 3.0 ACCIDENT ANALYSIS

### 3.1 Accident Comparison between Passenger Vessel and Other Marine Vessels

In the rivers and canals of Bangladesh, there are many types of vessels move on a daily basis. As for example: passenger vessels, oil tankers, bulk carriers, fishing boats etc. Among them, an accidental data analysis has been run and the result shows that 30% of these accident incidents happen in the case of passenger vessels [2].

From the year 1981 to 2015, the comparison of passenger vessel accidents to other vessel accidents are given below:

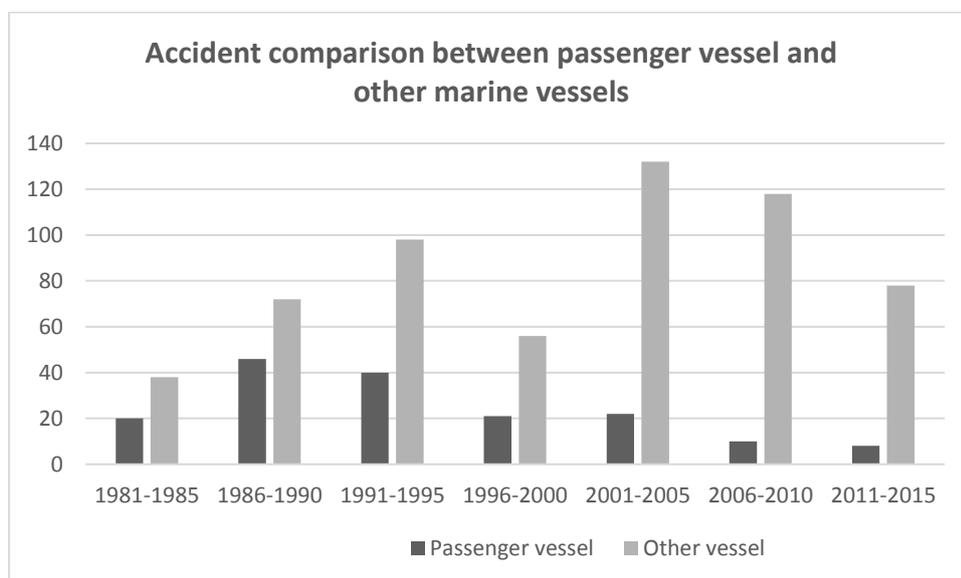


Figure 1: Comparison between passenger vessel and other vessel accidents [2].

### 3.2 Passenger Vessel Accident Analysis throughout the Year

During the monsoon, from the month April to July, the probability of accidents are pretty high due to bad weather. Lack of navigation aids and skilled man force are the main reasons behind the accidents. Month wise distribution of passenger vessel accidents are given below:

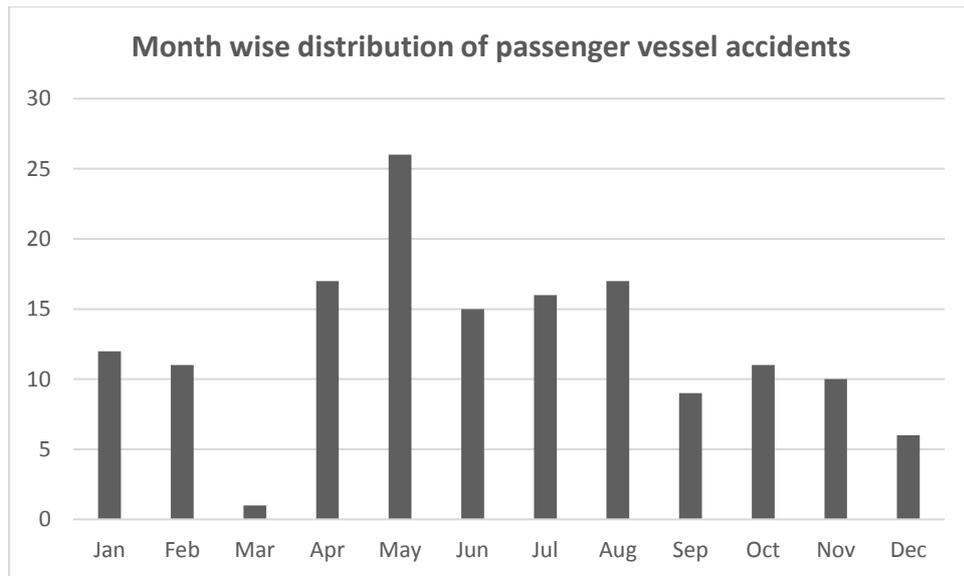


Figure 2: Month wise distribution of passenger vessel accidents [2]

It is pretty clear that, from April to August, the rate of passenger vessels accidents is higher than other month of the year and in May this rate is the highest.

#### 4.0 CAUSES OF PASSENGER VESSEL ACCIDENTS

This paper initiates a proposal to prevent overloading problem of passenger vessels. At the same time, the other probable reasons behind the passenger vessels accidents have been identified and discussed in short in this paper. From the available data and information, there are five main causes which are responsible for the passenger vessel accidents in inland waterways. These reasons are collision, overloading, fire and explosion, inclement weather and bottom damage. Figure (3) shows the percentages of the maritime accidents in Bangladesh.

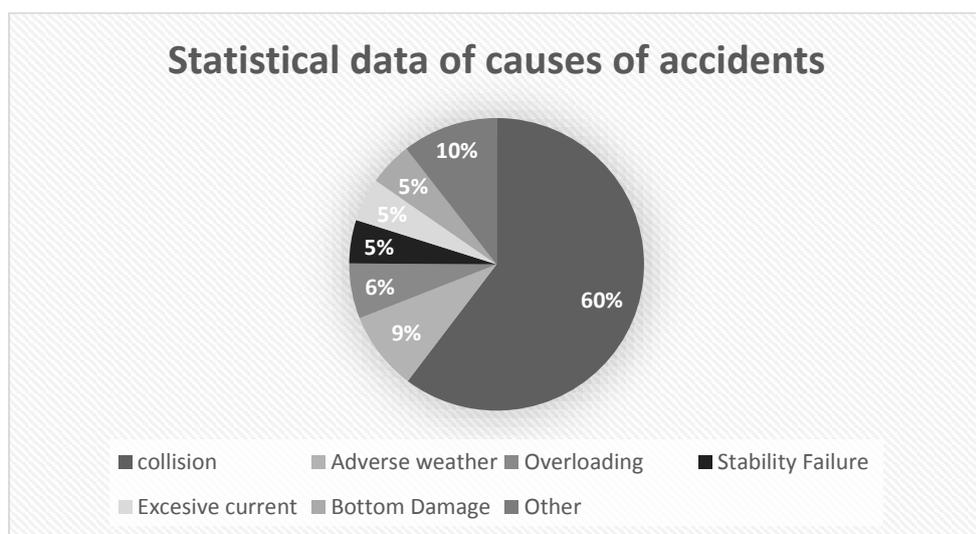


Figure 3: Statistical data of causes of accident [1].

It is observed that collision (60.3%) by the vessels is the main cause of accident. 92% of this collision takes place by the contact with other vessels. The rest 8% takes place by the contact with any permanent obstruction on the waterway route. The probable reason behind this high percentage of collision accidents may be due to absence of sufficient navigational aids on waterway routes and less skill of the vessel drivers, masters and crews. The adverse weather related accidents (8.7%) generally take place during the monsoon season weather often remains rough in nature [1].

#### **4.1 Collision**

Collision is one of the main reasons behind the passenger vessel accidents in inland waterways of Bangladesh. Most of the inland passenger vessels do not have any legal fitness certificate or route permit. Most of the operators of passenger vessels are not skilled enough and do not even have an authorized license. As a result, they do not have any proper training and knowledge on passenger vessel navigation and on the International Conventions and Regulations like COLREG. These unauthorized operators often misunderstand the signs and signals and violate the maritime rules and regulations. Thus collision is occurred and it cause casualties in inland waterways.

#### **4.2 Overloading**

Bangladesh is a densely populated country and the number of available transportations is always less than the demands of this huge population. Moreover, the greedy owners of the passenger vessels often take more passengers and cargo on the deck of the passenger vessels beyond the capacity of the vessels. As a result, overloading takes place and causes accidents.

If an unstable vessel inclines up to a certain angle (flooding angle), there may be two cases:

- It will not be able to return to its upright condition rather it will incline more and it will lose the stability and capsize finally.
- The inclination may not occur and the vessel may finish its voyage somehow.

Some reasons like inclement weather or water turbulence may cause this inclination up to the flooding angle.

While designing any vessel, four loading conditions are generally considered and the vessel must satisfy all the stability criteria at those conditions, they are:

- Full Load Departure Condition
- Full Load Arrival Condition
- Departure Condition without Load
- Arrival Condition without Load

Consideration of overloading condition in design means keeping a margin of safety up to a certain limit. In case of the existing traditional design of Bangladesh inland passenger vessels, the ratio of lateral area above the load water line (exposed to wind) to the underwater part is large and the down flooding angle is less due to opening of engine room. Due to this, the stability criteria are satisfied minimally i.e., there remains no safety margin [3].

#### **4.3 Fire and Explosion**

Maximum time, the structural fire protection plan and fire control plan are not properly followed by the passenger vessels owners and operators. Necessary insulations are not adopted most of the time. As per the fire safety rule, A-60 insulation is mandatory in the places like the galley and the machinery space where fire can occur generally [1] Emergency fire escape or lifesaving equipments are also insufficient in maximum

passenger vessels. To make the situation worse, lack of knowledge on SOLAS (Safety of Life at Sea) of the vessels operators is always there. And all these reasons are responsible for maritime accidents in passenger vessels sometimes.

#### 4.4 Inclement Weather

At calm weather or water, environmental forces do not affect a vessel. But in case of inclement weather, the vessel experiences forces on it from the direction of wind or current or may be both at a time. Because of the lateral area is more exposed, the effect of stormy wind and huge current tends to roll the vessel. As per rule, passenger vessels are not permitted to ply at a wind speed more than 10 m/s and on the basis of this wind speed the wind pressure has been due to inclement weather when the pressure is more than the defined volume. [4]

But the scenario of Bangladesh is not promising. To make more profit during the rush hour, the safety rules are broken by the passenger vessel owners and operators and severe accidents take place. Strong monitoring by the authority is needed in this area.

#### 4.5 Bottom Damage

Most of the passenger vessels in Bangladesh are not designed as per the Rule books. Maximum owners of passenger vessels are not willing to pay for the additional design costs and as a result, the builders ignore some basic structural rules to avoid this additional cost sometimes. These ill designed vessels do not meet the minimum still water bending moment (hogging/sagging) and they do not have any preliminary longitudinal strength calculation or any proper scantling calculation. All these cause bottom damage in passenger vessels.

#### 4.6 Case studies:

Some major accidents of passenger vessels of last 10 years [5].

Table 1: Major accidents of passenger vessel of the last 10 years

Vessel (Type)	Total death	Year	Reported cause by BIWTA
M.L. Pinak-6 (passenger)	47	2014	Strong Current & Overloading
M.V. Miraz-4 (passenger)	56	2014	Overloading and Nor`wester
M.V. Shariatpur-1 (passenger)	146	2012	Collision
M.B. Chandpur (passenger)	50	2008	Storm & over loading
M.L. Shourav-1 (passenger)	50	2008	Collision
M.V. Lighting Sun (passenger)	61	2004	Nor`wester

From the case studies, it can be seen that collision and overloading are the two main reasons behind those accidents.

## 5.0 SIGNAL BLOCKING SYSTEM TO PREVENT OVER LOADING IN PASSENGER VESSEL

The first task is to calculate the weight of the ship at berthed position. From the design data, the design draft for the maximum allowable load will be known certainly. For the design draft, there will be a definite water line marking. Now, because of increased weight, the draft will also increase. So, the waterline marking for maximum allowable load will go under water. Now, a sensor system at the outer side of the forward portion of the hull will be set up. The aim of this system will be to sense the rise of water and send a signal afterwards. The receiver in the control unit will receive this signal and will send it to the process unit. The main algorithm of this process will be that, if overloading occurs, the electronic signal which mainly starts the engine will be blocked automatically. This paper proposes to use this whole system for all the passenger vessels of Bangladesh.

When the proposed system is not applied, the schematic diagram of the signal to start the engine from control panel can be shown simply as:

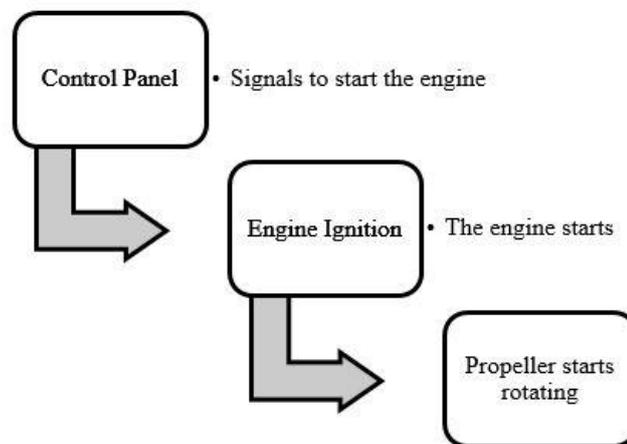


Figure 4: Schematic diagram of ship engine ignition by signaling from the control panel

And if our proposed system is applied, the schematic diagram of the system will be simplified as:

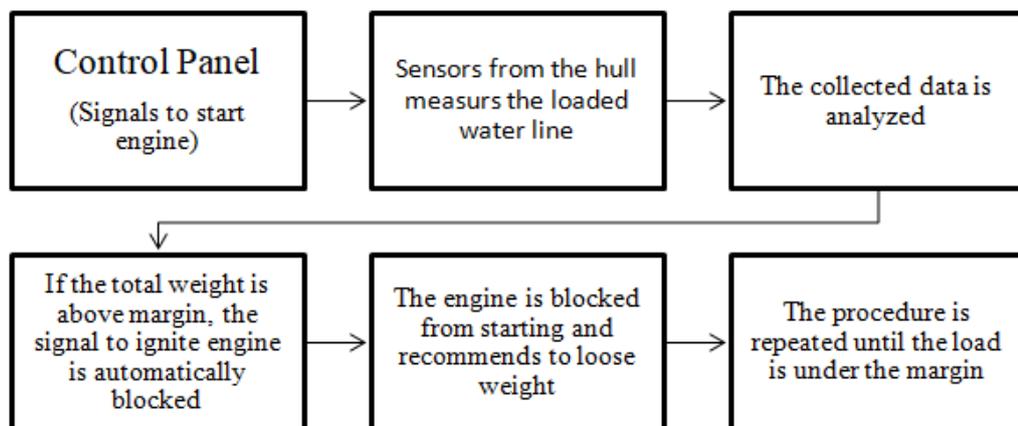


Figure 5: Schematic diagram of signal blocking system to prevent over loading of a passenger vessel

## 6.0 CONCLUSION AND RECOMMENDATION

From all the case studies and information provided in this paper, it is proved that overloading is one of the major reasons for passenger vessels accidents in inland waterways. In fact overloading is not a problem to solve; it is a matter to prevent – by any means, at any cost. As per Iqbal et al [6] “Overloading is not a pure Naval Architecture problem”. Therefore, some recommendations are made in the conclusion of this paper those are quite applicable in case of the prevention of overloading problems of passenger vessels in inland waterways of Bangladesh.

1. A set of new and standard prototype designs must be approved with the proposed set up in this paper. These designs must go under proper model testing before their construction.
2. Government or concerned authority should take necessary steps to incorporate the proposed set up in every passenger vessels to prevent overloading problem.
3. Committee with appropriate authority and more credibility should be formed to investigate on the maritime accidents and the authentic reports should be published.
4. There should be a mobile court to make sure that the proposed set up is adopted in all passenger vessels and to monitor the overall safety regulations are followed properly or not.
5. All the vessels must go under necessary tests like inclination tests, watertight integrity test and other stability tests before plying on the inland waterways.
6. Licenses of passenger vessels violating the safety rules should be banned.
7. Every passenger vessel should have at least four loading conditions which satisfies the stability criteria and approved by authority.
8. Carrying extra cargo on the top deck of the passenger vessels must be stopped to prevent overloading in passenger vessels.

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