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# Secure Ferry

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**Abstract***:* In this paper we are proposing and designing a safety mechanism for passenger boats. Every year, boat accidents take place all over the globe; most of the accidents occur due to overloading of passengers during peak hours. This project aims to reduce boat accidents to a great extent. Here the boat is fitted with a balancing system so that in case of an overload due to which the boat may become disoriented, the boat will be able to regain it's balance and continue it's journey. In addition to the balancing system, an alert system is fitted on the boat so that in the case the boat balance goes out of hand and the boat topples over, the closest rescue team is called on the scene. The balancing circuit chiefly consists of an accelerometer which progressively measures the angle at which the boat is aligned. The accelerometer is in turn connected to a microcontroller chip, which is programmed to accordingly initiate strategies for proper boat orientation. The alert system primarily consists of a GSM module which is connected to the microcontroller chip. It also consists of a GPS module to track the location of the boat continuously. The major hardware components used are PIC 16F877A, accelerometer, GSM (Global System for Mobile Communication) module, GPS (Global Positioning System) and LCD(Liquid Crystal Display). This technique helps to provide a safe journey over water and curtail boat disasters caused due to imbalance of boats.

**Keywords**: Balance system, overloading, PIC, GSM, GPS module.

## I. INTRODUCTION

Even though the Indian nation has developed in all aspects, especially the transportation sector being one of the chief areas of development, the chief mode of transport used by people living close to the backwaters is still water transport. Unlike the old times when all places were not well connected by roads, nowadays almost all the roads have been well interspersed so that people can go to and fro easily by using various automobiles. But even in this age, the boat traffic during peak hours is no joke and the number of people using passenger ferries to reach across to the other side for different purposes is quite a large and shocking number. Hence during rush hours, a large number of people travel by the same boat at a time, which is one of the chief causes for overloading of the ferry. Also boat drivers try to eke out maximum profits during rush hour so they don't turn away passengers easily. Therefore, the ferry becomes overfilled and there's a high probability for the boat to tilt to the heavier side. If this matter is taken lightly, there is a good chance for the boat to flip over unless appropriate methods for balancing boat weight are followed. In most cases, boat accidents take place due to overburdening of boat and subsequent disorientation, which causes the boat to fall over.

Every year, numerous boat accidents take place due to imbalance of boat. Hence, it is deemed very essential that the balance of passenger boats be checked continuously as it moves. The most cost effective way is to allow the stipulated number of passengers (as per design of the boat) only at a time in order to check crowding of the ferry.

In this project, we are designing a balance system such that the microcontroller receives information from the accelerometer regarding the balance/imbalance conditions and accordingly opts for mitigation strategies to regain balance. An alert system is also designed such that if the balance of boat can't be obtained, a GSM module is used to contact any nearby rescue force or contacts.

## II. LITERATURE REVIEW

Passenger boats have been widely in use in the Kerala backwaters for quite some time now. The passenger ferry as well as the historic 'chundanvallam' is actually a marker of Kerala's tradition. Boats purely made of wood have paved the way for modern boats made of more rust resistant and strong materials. The boat tragedy which marked the highest death toll happened in Thekkady in 2009[3].The primary cause of the Thekkady boat tragedy which took place on June 30,2009 was that the passengers rushed to one side of the boat to see a herd of bison which emerged from the forest. The sudden movement caused the boat to capsize and all the passengers were thrown into the water. The boat had also been overloaded with 87 people when it could only carry 74 people. The boat had also been apparently tilted for quite some time due to structural problems but had been overlooked by the crew of the boat. This negligence on the part of the crew of the boat cost a number of lives that day. Sadly, no lifejackets were provided to the passengers and there were no lifeguards in the vicinity.

The government has been blamed for not enforcing safety precautions and efficient disaster recovery plans as it was a boat owned by the Kerala Tourism Development Corporation. In the aftermath of the incident, then tourism minister announced several new safety measures: safety checks for boats, mandatory life jackets for those under 15 and provision of lifeguards for those above age 15 in proportion to the number of passengers. Another painful boat tragedy was the Thattekad boat mishap. It had claimed 18 lives, including three teachers and 15 students who had gone for a picnic .The tragedy occurred when water leaked into their, boat, causing it to overturn. The boat had also been in bad condition and was overloaded. At present no lessons have still been learnt from these boat tragedies as still no effective safety measures have been implemented in the boats used in the backwaters of Kerala. The boat transport rules have been modified to

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implement use of lifejackets and lifeboats but it's essentially still just a rule.

The IEEE paper on "Research based on communication and localization of small and medium boats", GPS module and other small scale communication devices have been used [2]. Satellite aided navigation is mainly used for secure and emergency response. [2]

The problematic domain is the imbalance caused by the tilt of the boat and absolutely no means of communication between the boat driver and the nearest rescue force or adjacent boats in case of a calamity. There has not been much development in the boat industries especially in it's protection area and it's communication with adjacent boats and control station.

There is no way by which the passengers or driver could be informed of an impending disaster and no means to get in touch with the closest control stations or call for help from other boats and all methods are mostly restricted by network coverage.

## III. BLOCKDIAGRAM OF THE PROJECT

Figure 1 shows the basic block diagram of the project work. The major hardware components used are PIC 16F877A, an accelerometer, GSM module, GPS module and LCD (16x2 display). Embedded C using micro C and PIC C programming is used as the software requirement. The accelerometer is an electromechanical device that will measure acceleration forces. An accelerometer is a device that measures the vibration, or acceleration of motion of a structure. The force caused by vibration or a change in motion (acceleration) causes the mass to "squeeze" the piezoelectric material which produces an electrical charge that is proportional to the force exerted upon it. A GPS module is fitted on the boat to track it's location.. GSM module is used for communication between the boat and the closest rescue forces and helplines in the proximity of the boat's location.

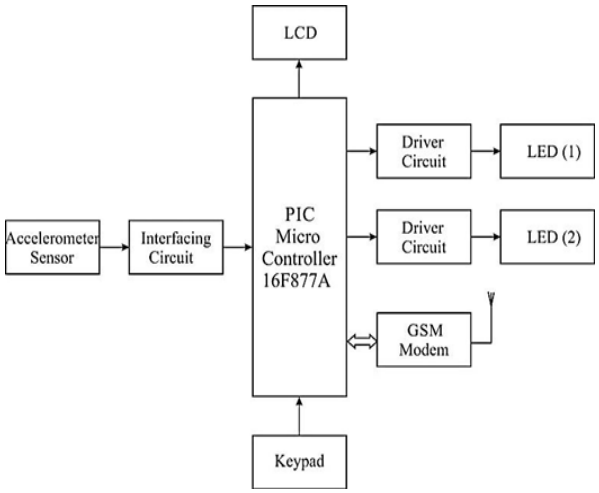


Fig. 1.Basic Block Diagram

The working of the project is explained as follows. Accelerometer measures the tilt of the boat and gives corresponding electrical values to the PIC microcontroller indicating the value of tilt angle. The GPS module gives the position of the boat instantaneously to the microcontroller. The LCD module displays the value from the accelerometer and if the boat goes overboard, the display indicates an alert message. The GSM module is used to communicate with the nearby rescue forces in case of a mishap. The keypad is connected to the PIC microcontroller unit and is used to select the emergency number to which the alert message has to be sent in case of an accident.

## IV. WORKING OF THE PROJECT

*CASE 1*

Fig 2 explains the situation when the tilt angle measured by the accelerometer is such that the boat is tilted to one direction (say right). If the tilt angle exceeds the optimum tilt angle, then the boat may tilt to the right and the corresponding airbag on the right inflates which is indicated by illumination of LED 1. Then the tilt on the right side is eradicated and the boat is balanced.

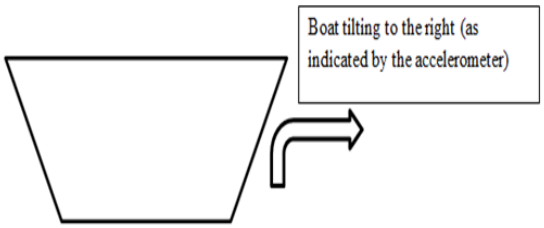


Fig. 2. Boat tilting to the right (case 1)

*CASE 2*

Fig 3 explains the situation when the tilt angle measured by the accelerometer is such that the boat is tilted to one direction (say left). If the tilt angle exceeds the optimum tilt angle, then the boat may tilt to the left and the corresponding airbag on the left inflates which is indicated by illumination of LED 2. Then the tilt on the left side is eradicated and the boat is balanced.

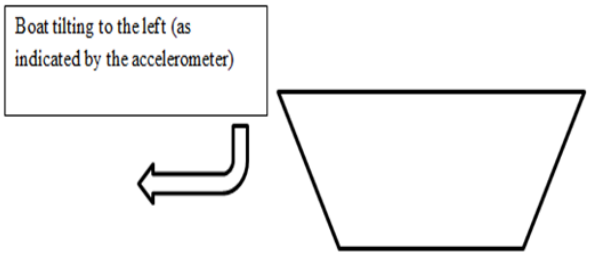


Fig.3. Boat tilting to the left (case 2).

*CASE 3*

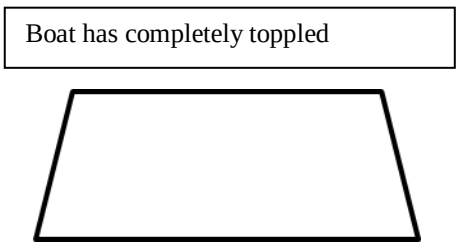


Fig. 4. Boat has completely turned over (case 3)

Fig 4 explains the situation when the tilt angle is such that the boat has completely toppled over. Then the LEDS 1

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and 2 corresponding to the airbags on either side are inflated so that the passengers can hold on to the airbags and remain afloat.

At that point the GPS location fed to the microcontroller is transmitted to the GSM module which transmits the corresponding alert signal to the rescue operations in the vicinity.

In this project we are demonstrating the use of airbags by illuminating LEDs. In the practical scenario the airbags can be replaced by water bags. These water bags act as counter weights. When the boat is tilted to the left, the water bags on the right are pumped with water via motor. Similarly, when the boat is tilted to the right, the water bags on the left are pumped with water via a motor. Hence, the effect of imbalance caused by overload is controlled.

## V. SIMULATION OF THE BOAT BALANCE PROJECT

Fig 5 shows the simulation diagram of the boat balance system.

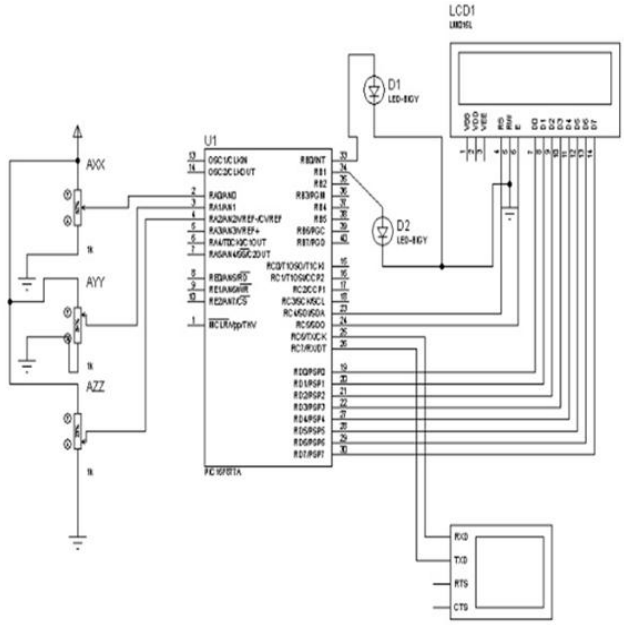


Fig.5.Simulation of boat balance system

The readings/tilt measured by the accelerometer is fed to a microcontroller chip (PIC 16F877A). Here in the simulation, the action of the three axis accelerometer is simulated using three ADC's (Analog to Digital Converter). The microcontroller is programmed to read the value of tilt of the boat and take corresponding precautionary/alert action. If the boat tilts to the right or left above the value of allowed tilt angle, the corresponding airbags on the tilted side are inflated to balance the boat. Now, here in the project we are demonstrating the inflation of left/right side airbags via LED's. If the angle of tilt is such that the boat turns over, both LED's are illuminated (i.e. in the practical scenario, it's a signal for the airbags to be inflated on both sides so that the drowning passengers can hold on to it and remain afloat. The GPS module also reads the location of the boat then the information is transmitted wirelessly using GSM module to the local authorities and nearby rescue operations.

The software used for the simulation of the project is Proteus software. The program is written the language Keil C which helps in converting a given program into corresponding hexcode.

The GSM module helps transmit information wirelessly to the local forces so that the people in the boat can be saved in time from drowning. A 16X2 LCD (Liquid Crystal Display) is used to displaythe action taken by the PIC microcontroller (i.e. either light LED1 or LED2).

## VI.CONCLUSION

A method for balancing a passenger boat when overloaded and an alert system has been discussed here. The discussed project is cost effective and quite simple to construct .The chief component is the accelerometer. It measures the angle of the tilt of the boat and sends the value to a microcontroller unit. Hence, by using this system, the boat operator will be able to prevent any mishap associated with tilt of the boat. The best way is to prevent overloading of passenger boats for the safety of all. In [1], an anti-tilting system is fabricated using a Zigbee module. More advanced balancing and alert systems could be designed and implemented but it will result in increase of cost.

## ACKNOWLEDGMENT

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