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Anti-Tilting System and Protective Measures on Small Scale Boats

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Abstract

Many accidents have occurred in boats due to tilting and the imbalance hence formed, increased no of passengers and delay in providing help. Here we introduce anti tilting system which gives solution to the same by a mechanism of equalizing the weight in two tanks. For immediate communication between the control station, boat and nearby boats we provide GSM, GPS and zigbee network which can be manually controlled by an emergency switch.

Keywords: *Accelerometer, Zigbee networks, Motor driver, GPS,GSM.*

1. Introduction

Thattekkadu boat accident was a major water disaster. The main reason of the accident was reported as the tilt and imbalance that was formed when passengers moved to one side of the boat.

The microcontroller used here is PIC 18F23K22 from Microchip. It is a 28 pin chip and has Dual in line package. An accelerometer is used as the tilt sensor. It has 3 scales that measures in X, Y,Z directions. The output voltage is the change in any of the values. Here two IR sensors are used as counters. The number of passengers getting on the boat is incremented and getting off are decremented and if the output value is greater than the threshold, then the ignition is turned OFF. A viper pump is used as the water pump for obtaining powerful pumping of water. A 12 volt relay is used for driving the motor Here we use GPS, global position system helps to obtain the position of the boat. The GPS value is sent as a message to the control station by means of GSM. We also used ZIGBEE module. A network of communication that requires no mobile coverage. Thus it helps in overcoming the coverage limitations of GSM.

2. Related Works

The IEEE paper on "Research based on communication and localization of small and medium fishing boats" [1] deals with GPS and other small scale communication devices. GPS in marine communication [2] describes Satellite aided navigation (accurate positioning). It is mainly used for secure and emergency response.Ferry design for vehicle and passenger transportation in 1980's. [3] Considers the basic design for ferries. The proposed approach is not applied in our paper as the design in the mentioned paper is 35 years old. Planning and design of floating berths for passenger-only ferry terminals [4] is an IEEE paper boat designs. It has better design than that of [3]. Zigbee/GPS tracking system for rowing races [5] discusses about most advanced communication system, the Zigbee network. In this paper, the zigbee network is taken as a safety system. It has also employed real time monitoring.

3. Problem Domain

The problem domains are the imbalance due to the tilt of the boat, lack of regular communication between control station and boat. There is no way by which driver or passenger could inform that there is a mishap. No way to inform fellow boats and all existing methods depend on network coverage.

4. Motivation

4.1 Real Time Motivation

Thattekkadu boat accident was a major water disaster. This incident is the motivation for the project The main reason of the accident was reported as the tilt and imbalance that was formed when passengers moved to one side of the boat. And we have included some extra protection measures.

4.2 Technical Motivation

There has not been much development in the boat industries especially in its protection area and its communication with adjacent boats and control station.

5. Problem Definition and Statement

The problem domains are the imbalance due to the tilt of the boat, lack of regular communication between control station and boat. There is no way by which driver or passenger could inform that there is a mishap. No way to inform fellow boats and all existing methods depend on network coverage

6. Problem Issues

The problem can be stated as the tilts to the boat that can lead to imbalances, number of passengers to be entered to the boat, location of the boat and communication between station and other boats.

7. Problem Capture

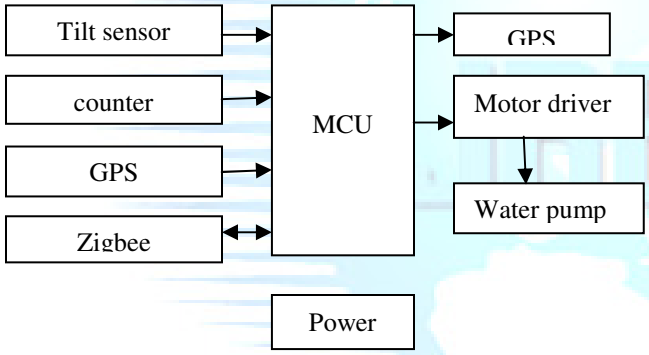


Fig.1. Block diagram of Boat

Fig. 1 shows the block diagram of Boat section.. The block diagram consists of seven sections as:

1) Tilt sensor
2) Counter
3) Microcontroller unit
4) GPS
5) Zigbee
6) GSM
7) Motor driver & water pump

Here we use PIC 18F23K22. It is 24 pin microcontroller driven by 5v, 2.5mA. It is an 8 bit microcontroller and has 3 ports. Most of the pins are multiplexed. In accelerometer X and Z scales are kept constant. Y scale moves to and fro from a fixed value, and the difference between these values will cause the resultant voltage. The zigbee has a logic high of 3.3 v for which a resistance kept as logic high of PIC is 5v. It has data in at pin 3 and data out at pin 2.In tilt sensor, the IR transmitters are made as 2 in a set for increasing the power and thereby the efficiency. The IR receiver collects the break in the flow of light energy. It is passed to transistor BC 547 and then to PIC as IRout1 and IRout2.

To drive the water pump a 12 v relay is kept. A freewheeling diode is kept across the relay to nullify the reverse current. For clock, an oscillator of 20 MHz is connected to pin 10. The power is supplied at pin 8 and is grounded at pin 16.

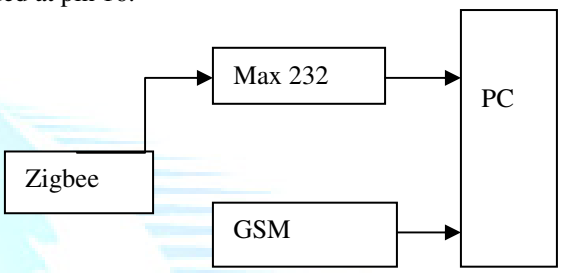


Fig 2. Block diagram of control section

8. Algorithm

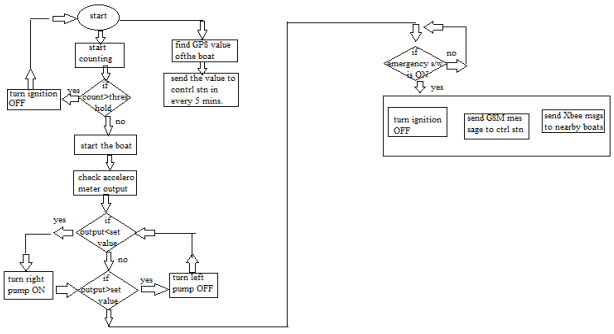


Fig. 1. Algorithm of Boat Security System

9. Circuit Diagram

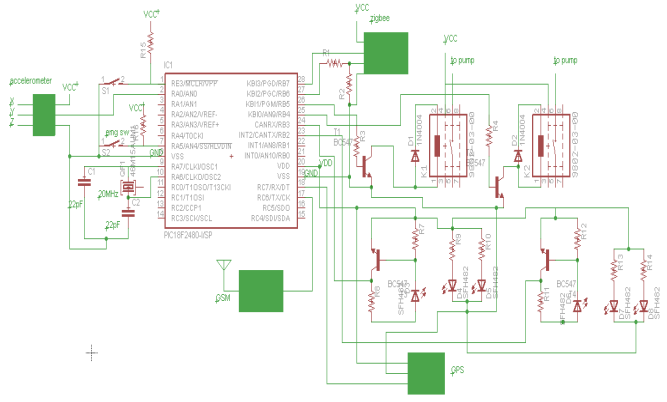
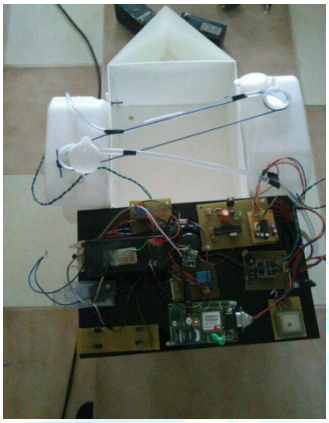


Fig. 2. Circuit diagram of Boat Security System



10. Input-Output Model

10.1 Microcontroller

Input: data from accelerometer
Process: checks the value and puts them in the program
Output: data to the motor driver

10.2 Accelerometer

Input: change in water level
Process: produces output voltage
Output: 0-5V

10.3 Motor Driver

Input: Voltage from accelerometer
Process: couples the voltage to motor
Output: 12V to motor

10.4 Motor

Input: 12V from delay
Process: force is generated which pumps the switch
Output: Pumps water to the other tank

10.5 Battery

Input: DC voltage
Process: The input DC voltage is stored as charge in the battery.
Output: Charge storage

10.6 GPS

Input: Data from emergency switch
Process: The RF availability and the battery charge level are displayed in terms of their percentage.
Output: Percentage display of both RF and battery charge levels.

10.7 GSM

Input: data from emergency switch
Process: transmit data to control station through mobile network
Output: transmit data to control station

10.8 Zigbee

Input: Data from emergency switch
Process: Wireless data transmission
Output: Data transmission

References

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