DESIGN OF BORDER ALERT SYSTEM FOR FISHERMEN USING GPS

ABSTRACT

The Tamil Nadu fishermen even today invoke the historical rights and routinely stay into the International Maritime Boundary Line (IMBL) for fishing. From Tamil Nadu about 18,000 boats of different kinds conduct fishing along the India-Sri Lanka maritime border. Fishermen from our country are being abducted by the Sri-Lankan navy for crossing the border which is unintentional most of the times. This issue causes much havoc between the two countries. The project deals with a system of tracking the location of the boat using GPS and aims at providing a system that will alert the fishermen well in advance and ensure maximum safety. The project also serves the purpose of providing peace at the borders and reduces the tensions between the two countries. The proposed system's architecture is reliable and robust. The greatest advantage of the GPS system is the ability of the device to work in any weather conditions and in any means.

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1.INTRODUCTION

The sea border between the countries is not easily identifiable, which is the main reason for this cross-border cruelty.

Here we have designed an embedded system which protects the fishermen by notifying the country border to them by using Global Positioning System (GPS). We use GPS receiver to find the current location of the fishing boat. The starting location values of the boat are stored in the Arduino by means of a set button. As the boat starts, the subsequent location values are continuously received by the GPS receiver and are compared with the maritime border. Then from the result of the comparison, this system aware the fishermen that they are about to reach the nautical border. The area is divided into two zones- safe zone & restricted zone. If the boat is in safe zone, then the LCD displays the current location values and the green LED is ' ON '. Thus, they can make it clear that the boat is in safe area. In case it moves further and reaches the restricted zone, the LCD displays ' warning zone 'and the buzzer turns 'ON '. If the fisherman fails to see the display or ignores the buzzer, the boat engine is out of manual control & it is reverted back automatically into the safe area.

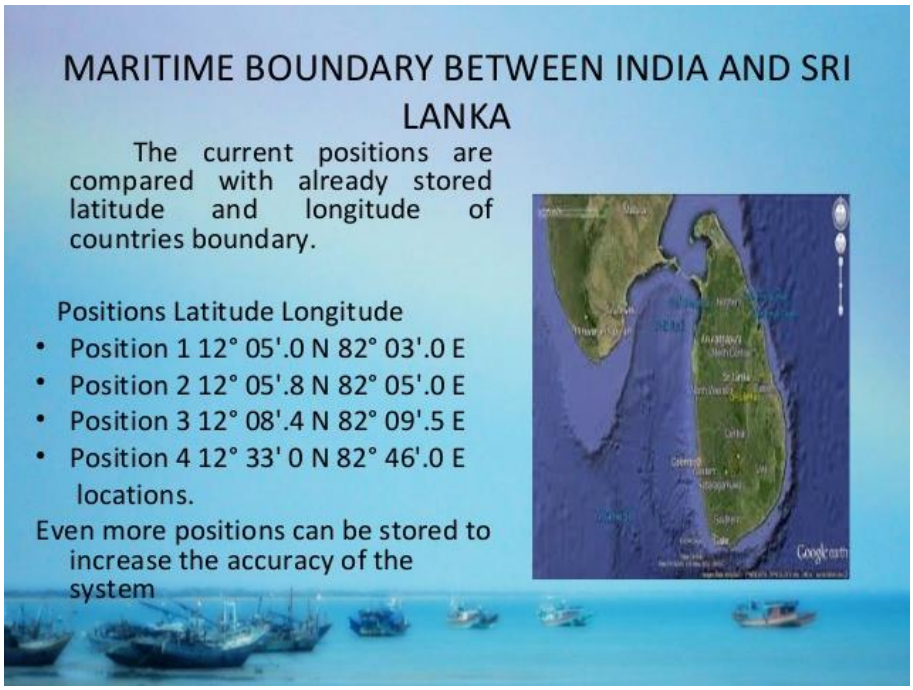

Fig.1 MARITIME BORDER BETWEEN INDIA AND SRILANKA

2. BLOCK DIAGRAM

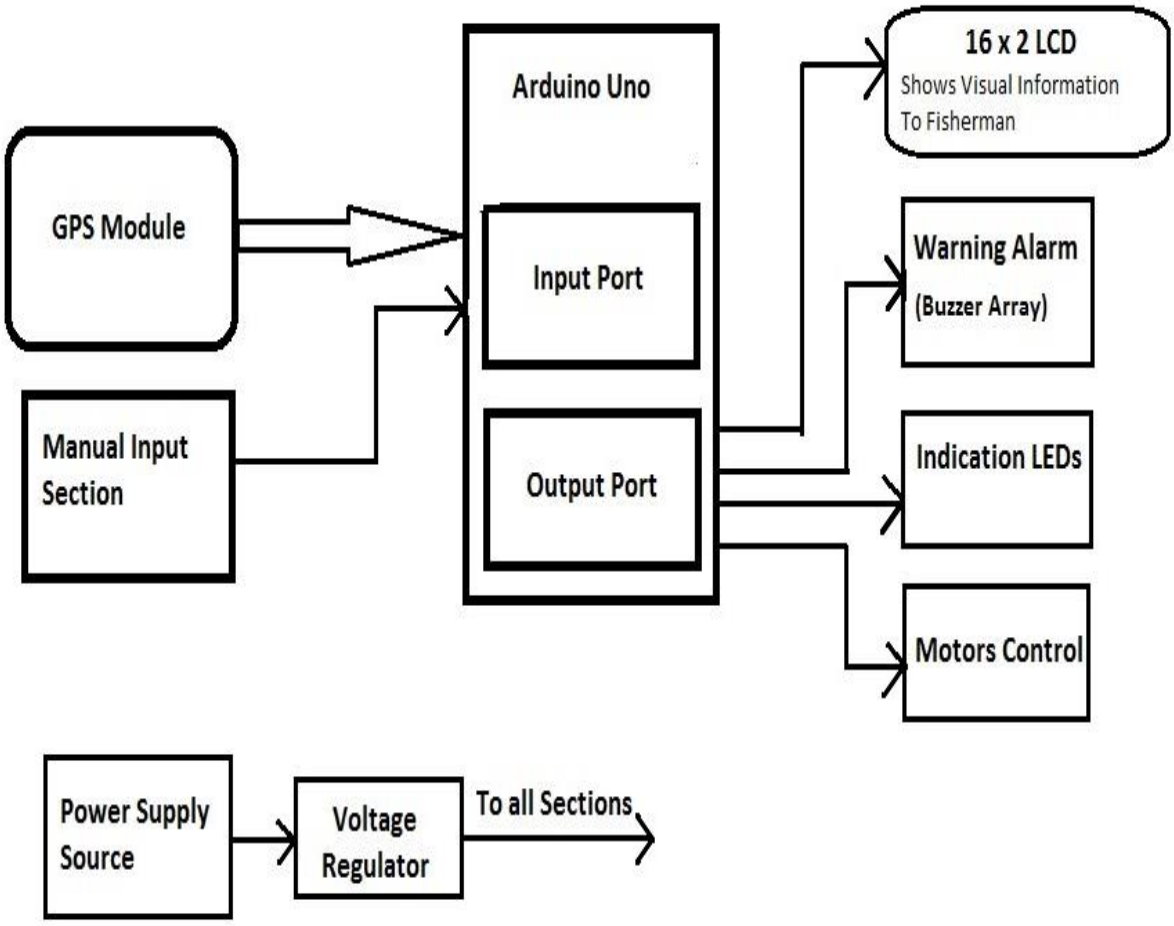

Fig.2: BLOCK DIAGRAM

3. CIRCUIT DIAGRAM

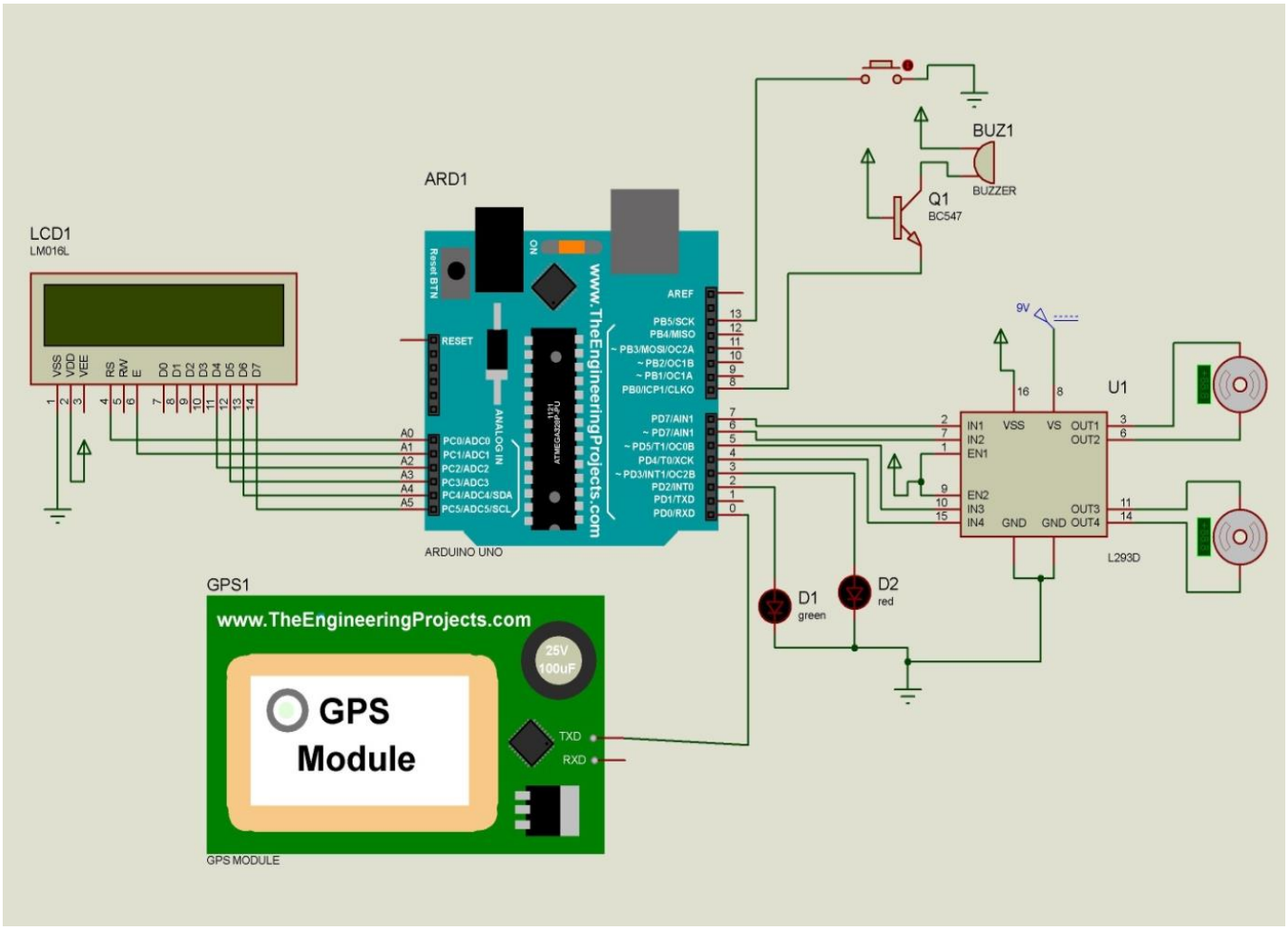

Fig.3: CIRCUIT DIAGRAM

4. COMPONENTS AND PIN DIAGRAMS

4.1. ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

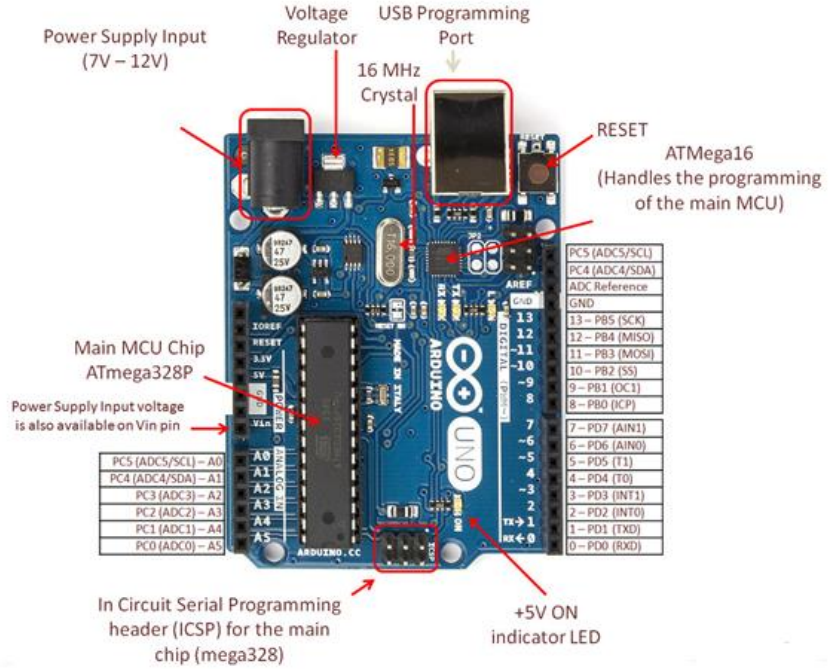

Fig.4: ARDUINO UNO

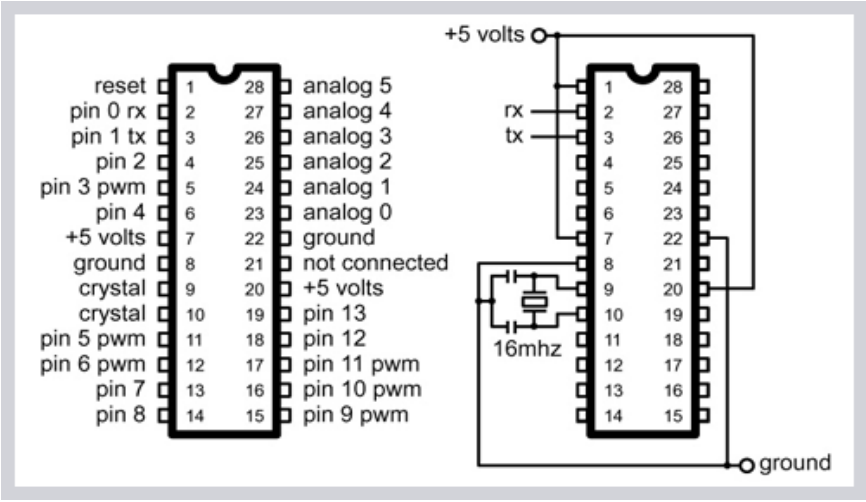

Fig.5: PIN DIAGRAM OF ATMEGA 328P IN ARDUINO UNO

4.1.1. Technical Specifications

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
Flash Memory	32 KB of which 0.5 KB used by boot loader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

4.1.2. Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and V_{IN} pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

• V_{IN} - The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

• 5V - The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

• 3V3 - A 3.3volt supply generated by the on-board regulator. Maximum current draw is 50mA.

• GND - Ground pins.

4.1.3. Memory

The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the boot loader); It has also 2 KB of SRAM and 1 KB of EEPROM.

4.1.4. Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

• Serial: 0 (RX) and 1 (TX): Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

• External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

• PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

• SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

• LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

4.1.5. Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an *.inf file is required.

4.2. GPS MODULE

This GPS Receiver Modem is based on SIMCOM's SIM28M GPS Module. SIM28M is a stand-alone receiver. With built in LNA, SIM28M can relax antenna requirement and don't need for external LNA. SIM28M can track as low as -165 dbm signal even without network assistance. SIM28M has excellent low power consumption characteristics (acquisition 17 mA, tracking 16 mA). SIM28M supports various location and navigation applications including autonomous GPS , DGPS.

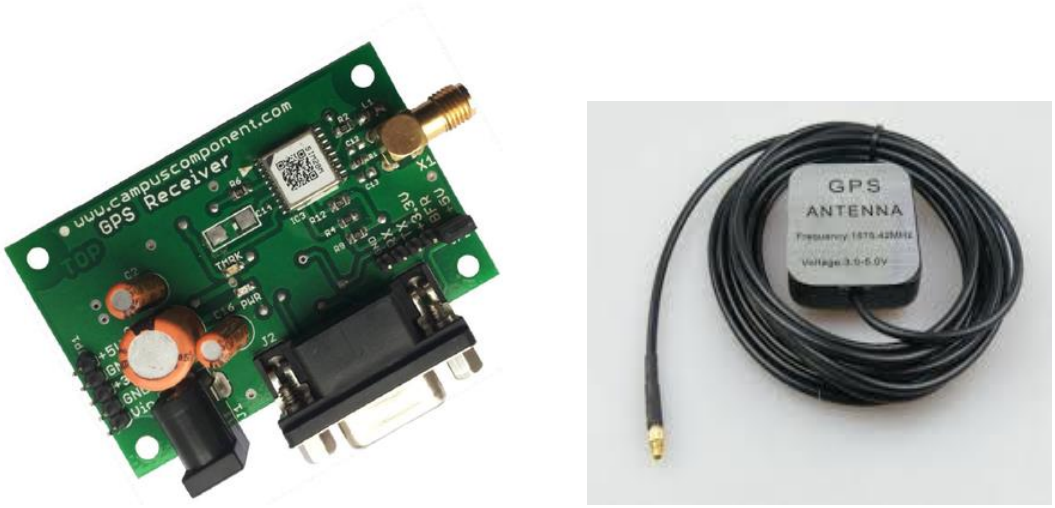

Fig.6: GPS RECEIVER AND ANTENNA

4.2.1. Power

A 9-15V DC (DC only) Adaptor can be used to power up this modem. Adaptor can be connected to DC socket (J1). 9-15V DC can be connected to Vin (input voltage) and GND (ground 0V) pins at male header (JP1). A diode D1 protects the modem from reverse polarity. User can also power up this modem by sharing voltage level +5V or +3.3V from their other circuit boards. +5V or +3.3V must be connected at JP1.

4.2.2. Electrical data

• Power supply: +2.8V ~4.3V
• Backup power: +2.0V ~4.3V
• Power consumption2,5
- Acquisition: 17mA
- Tracking: 16mA
- Backup: 8μA

• Antenna type

- Active and Passive

• Antenna power

- External or internal

4.2.3. Performance data

• Receiver type

- 22 tracking / 66 acquisition- channel GPS receiver GPS L1, C/A Code

• Max. update rate

- 10Hz

• Sensitivity1

- Tracking: -165 dBm

- Reacquisition: -160 dBm

- Cold starts: -148 dBm

• Accuracy

- Automatic Position3: 2.5m CEP

- Speed4: 0.1m/s

- Timing: 10ns

• Operation temperature: -40℃~+85 ℃

4.2.4. Features

• Support EASYTM self-generated orbit prediction

• Support EPOTM orbit prediction

• Support AGPS

• Support SBAS ranging (WAAS, EGNOS, GAGAN, MSAS)

• Support Jamming removing function

• Low-noise amplifier has been integrated

4.2.5. Interfaces

• Serial interfaces

- UART

• Protocols

- NMEA,PMTK,PSIM

4.3. LIQUID CRYSTAL DISPLAY

Lcd stands for liquid crystal display. Character and graphical lcd's are most common among hobbyist and diy electronic circuit/project makers. Since their interface serial/parallel pins are defined so it's easy to interface them with many microcontrollers. Many products we see in our daily life have lcd's with them. They are used to show status of the product or provide interface for inputting or selecting some process. Washing machine, microwave, air conditioners and mat cleaners are few examples of products that have character or graphical lcd's installed in them.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

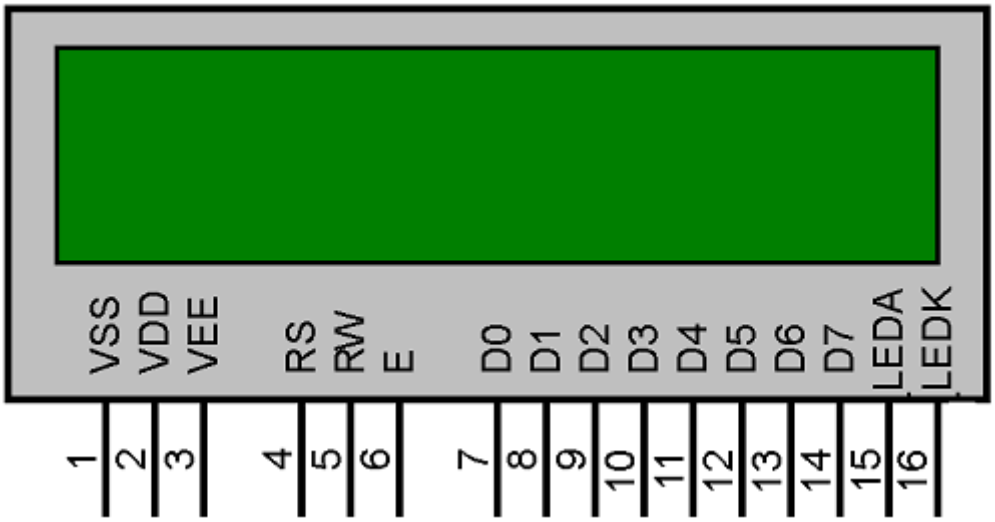

Fig.7: PIN DIAGRAM OF LCD DISPLAY

The LCD can work in two different modes, namely the 4-bit mode and the 8-bit mode. In 4 bit mode we send the data nibble by nibble, first upper nibble and then lower nibble. For those of you who don't know what a nibble is: a nibble is a group of four bits, so the lower four bits (D0-D3) of a byte form the lower nibble while the upper four bits (D4-D7) of a byte form the higher nibble. This enables us to send 8 bit data. Whereas in 8 bit mode we can send the 8-bit data directly in one stroke since we use all the 8 data lines. Now you must have guessed it, Yes 8-bit mode is faster and flawless than 4-bit mode. But the major drawback is that it needs 8 data lines connected to the microcontroller. This will make us run out of I/O pins on our MCU, so 4-bit mode is widely used. No control pins are used to set these modes. It's just the way of programming that change.

4.3.1. Pin Description

Sr. No	Pin No.	Pin Name	Pin Type	Pin Description	Pin Connection
1	Pin 1	Ground	Source Pin	This is a ground pin of LCD	Connected to the ground of the MCU/ Power source
2	Pin 2	VCC	Source Pin	This is the supply voltage pin of LCD	Connected to the supply pin of Power source
3	Pin 3	V0/VEE	Control Pin	Adjusts the contrast of the LCD.	Connected to a variable POT that can source 0-5V
4	Pin 4	Register Select	Control Pin	Toggles between Command/Data Register	Connected to a MCU pin and gets either 0 or 1. 0 -> Command Mode 1-> Data Mode
5	Pin 5	Read/Write	Control Pin	Toggles the LCD between Read/Write Operation	Connected to a MCU pin and gets either 0 or 1. 0 -> Write Operation 1-> Read Operation
6	Pin 6	Enable	Control Pin	Must be held high to perform Read/Write Operation	Connected to MCU and always held high.
7	Pin 7-14	Data Bits (0-7)	Data/Command Pin	Pins used to send Command or data to the LCD.	In 4-Wire Mode Only 4 pins (0-3) is connected to MCU In 8-Wire Mode All 8 pins(0-7) are connected to MCU
8	Pin 15	LED Positive	LED Pin	Normal LED like operation to illuminate the LCD	Connected to +5V
9	Pin 16	LED Negative	LED Pin	Normal LED like operation to illuminate the LCD connected with GND.	Connected to ground

4.4. MOTOR DRIVER

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (*IC*).The l293d can drive small and quiet big motors as well.

Fig.8: MOTOR DRIVER IC (L293D)

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence H-bridge IC are ideal for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors.

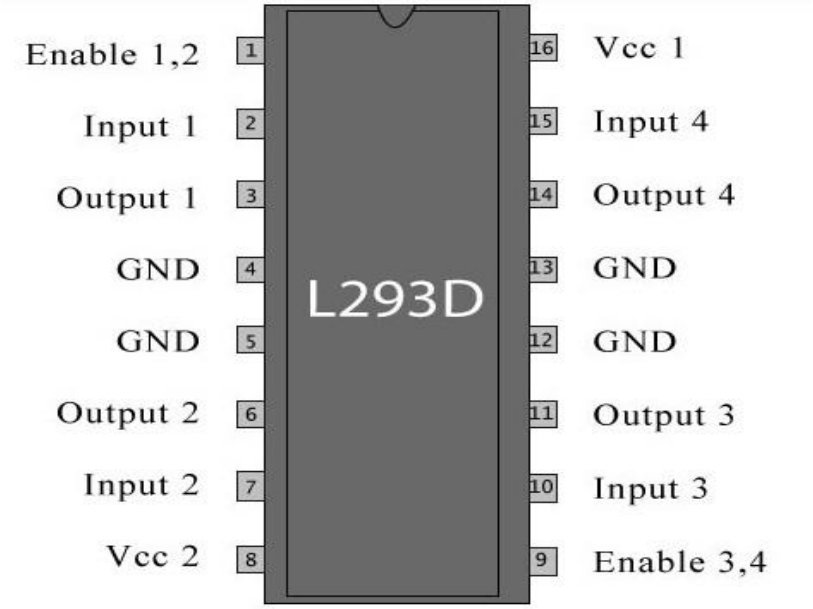

Fig.9: PIN DIAGRAM OF MOTOR DRIVER IC

4.4.1. Pin Description

PIN NO	FUNCTION	NAME
1	Enable pin for motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 2
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors;9-12V (up to 36V)	Vcc 2
9	Enable pin for Motor 2 active high	Enable 3,4
10	Input 1 for Motor 2	Input 3
11	Output 1 for Motor 2	Output 3
12	Ground (0V)	Ground
13	Ground (0V)	Ground
14	Output 2 for Motor 2	Output 4
15	Input 2 for Motor 2	Input 4
16	Supply voltage; 5V (up to 36V)	Vcc 1

4.4.2. Working

There are 4 input pins for l293d, pin 2, 7 on the left and pin 15, 10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

4.4.3. Logic table

Let’s consider a Motor connected on left side output pins (pin 3, 6). For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0. In a very similar way the motor can also operate across input pin 15, 10 for motor on the right hand side.

• Pin 2 = Logic 1 and Pin 7 = Logic 0 | Clockwise Direction
• Pin 2 = Logic 0 and Pin 7 = Logic 1 | Anticlockwise Direction
• Pin 2 = Logic 0 and Pin 7 = Logic 0 | Idle [No rotation] [Hi-Impedance state]
• Pin 2 = Logic 1 and Pin 7 = Logic 1 | Idle [No rotation]

4.4.4. Voltage Specification

VCC is the voltage that it needs for its own internal operation 5v; L293D will not use this voltage for driving the motor. For driving the motors it has a separate provision to provide motor supply VSS (V supply). L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS Motor supply.

The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors Up to 36v hence you can drive pretty big motors with this l293d.

VCC pin 16 is the voltage for its own internal Operation. The maximum voltage ranges from 5v and up to 36v.

4.5. DC MOTOR

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

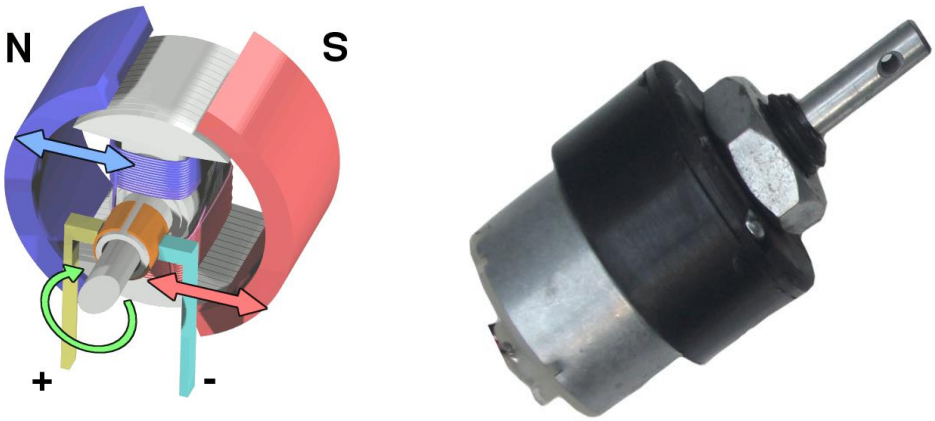

Fig.10: DC MOTOR

Workings of a brushed electric motor with a two-pole rotor (armature) and permanent magnet stator. "N" and "S" designate polarities on the inside axis faces of the magnets; the outside faces have opposite polarities. The + and - signs show where the DC current is applied to the commutator which supplies current to the armature coils

Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

4.6. PIEZOELECTRIC BUZZER

A buzzer or beeper is an audio signaling device which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. Piezoelectric buzzers, or piezo buzzers, as they are sometimes called, were invented by Japanese manufacturers and fitted into a wide array of products during the 1970s to 1980s. This advancement mainly came about because of cooperative efforts by Japanese manufacturing companies. In 1951, they established the Barium Titanate Application Research Committee, which allowed the companies to be "competitively cooperative" and bring about several piezoelectric innovations and inventions.

Fig.11: PIEZOELECTRIC DISK BEEPER

A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

4.7. LIGHT EMITTING DIODE

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when activated.[5]When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm^2) and integrated optical components may be used to shape the radiation pattern

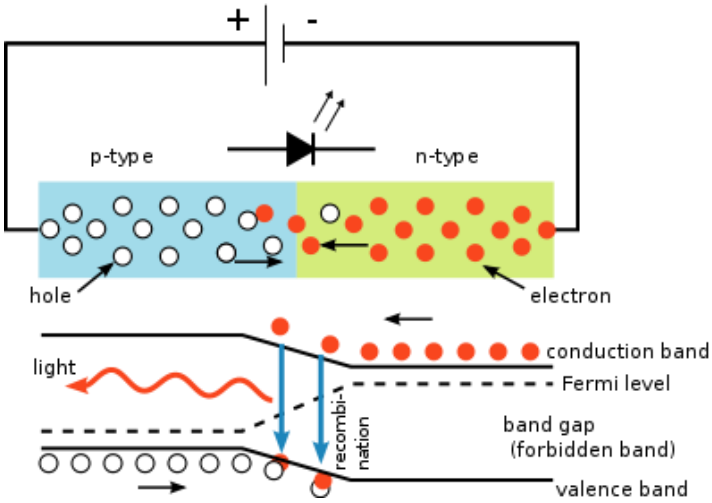

Fig.12: ENERGY BAND DIAGRAM

A P-N junction can convert absorbed light energy into a proportional electric current. The same process is reversed here (i.e. the P-N junction emits light when electrical energy is applied to it). This phenomenon is generally called electroluminescence, which can be defined as the emission of light from a semi-conductor under the influence of an electric field.

Fig.13: RED and GREEN Led's

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The charge carriers recombine in a forward-biased P-N junction as the electrons cross from the N-region and recombine with the holes existing in the P-region. Free electrons are in the conduction band of energy levels, while holes are in the valence energy band. Thus the energy level of the holes will be lesser than the energy levels of the electrons. Some portion of the energy must be dissipated in order to recombine the electrons and the holes. This energy is emitted in the form of heat and light.

4.8. PUSH BUTTON

A push button is a momentary or non-latching switch which causes a temporary change in the state of an electrical circuit only while the switch is physically actuated. An automatic mechanism (i.e. a spring) returns the switch to its default position immediately afterwards, restoring the initial circuit condition. There are two types:

- A push to make switch allows electricity to flow between its two contacts when held in. When the button is released, the circuit is broken. This type of switch is also known as a Normally Open (NO) Switch. (Examples: doorbell, computer case power switch, calculator buttons, individual keys on a keyboard)

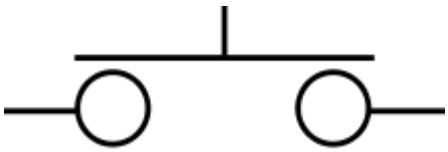

Fig.14: PUSH-TO-MAKE SWITCH ELECTRONIC SYMBOL

- A push to break switch does the opposite, i.e. when the button is not pressed, electricity can flow, but when it is pressed the circuit is broken. This type of switch is also known as a Normally Closed (NC) Switch. (Examples: Fridge Light Switch, Alarm Switches in Fail-Safe circuits)

Fig.15: PUSH-TO-BREAK SWITCH ELECTRONIC SYMBOL

Many Push switches are designed to function as *both* push to make *and* push to break switches. For these switches, the wiring of the switch determines whether the switch functions as a push to make or as a push to break switch.

Fig.16: PUSH BUTTON

5. PCB LAYOUT

PCB Wizard is a powerful package for designing single sided and double sided printed circuit boards. It provides a comprehensive range of tools covering all the traditional steps in PCB production, including schematic drawing , schematic capture, component placement, automatic routing, Bill of Materials reporting and file generation for manufacturing.

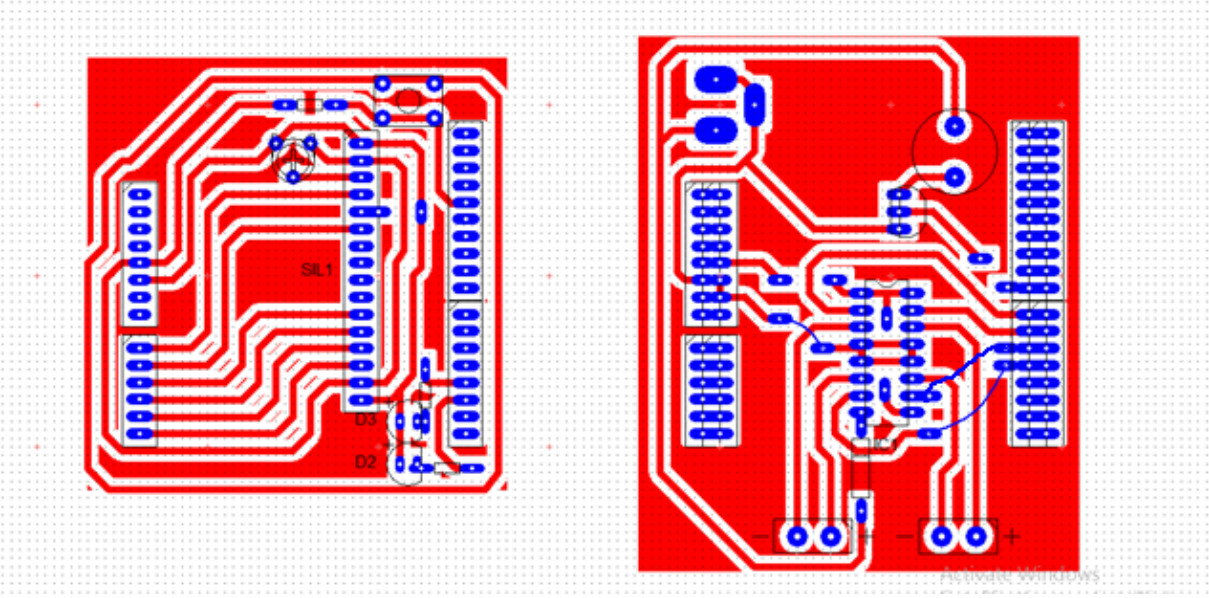

Fig.17: NORMAL VIEW

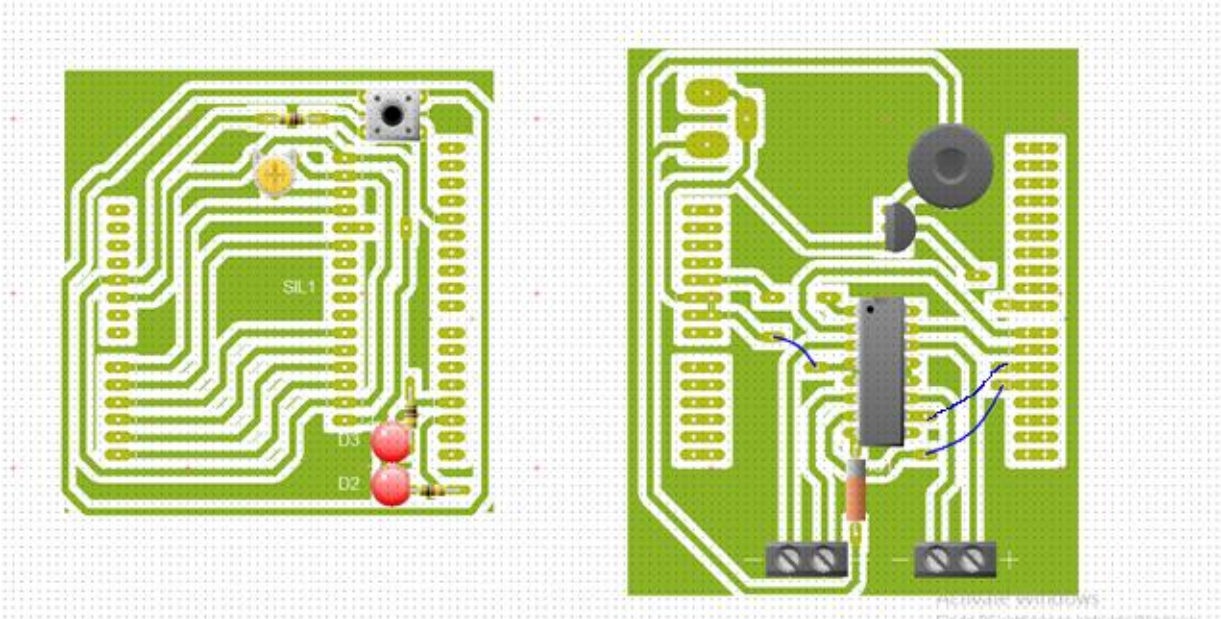

Fig.18: REAL VIEW

6. WORKING

ARDUINO UNO is the main body of the project, other components like GPS, LCD , motors , led's , buzzer are interfaced to it. These are OUTPUT's of the Arduino which are configured to particular pins by the pinMode command. The boat is represented here by the "bot" made of 2 dc gear motors and the whole circuit is set up on the chassis. The entire circuit is powered by the Arduino board, except the motor shield which is powered by the 9V battery supply. At the initial position, locations are received by the antenna of the GPS receiver. GPS sends the data through USART and are saved in the Arduino using 'location set' button. The Arduino reads the locations continuously from the GPS receiver, while the boat is moving. The green led is turned "ON", and LCD displays "Safe Zone". Then Arduino reads the location continuously from the GPS using Serial Read Command and compares with the stored range of boundary values. If the result of the comparison i.e., the current values are within the range, it then controls the LM293D IC which drives the motors in forward direction. Once the locations exceed the boundary values the red LED is turned "ON" and the boat gets automated. Arduino controls the motor driver IC to change the motor direction using the digitalWrite command. The buzzer is driven by the n-p-n transistor's collector voltage which beeps when the border is crossed and automation starts. Under the automation phase, the boat retraces back its path away from the border. In this process, the buzzer continuously beeps. The Arduino writes "Danger Zone" on the LCD screen using digitalWrite command. The boat stops when it reaches sufficiently into the safe zone, and the buzzer stops and the control of the boat shifts into the manual control by the fisherman.

7. SOFTWARES USED

- Arduino 1.0 IDE
- Proteus 8 Professional
- PCB Wizard 3.50 Pro Unlimited

8. REFERENCES

- M Rajendra Prasad, P Aswani Kumar," An Automated Traffic Accident Detection and Alarm Device" in International Journal of Technological Exploration and Learning (IJTEL), Volume 1 Issue 1 (August 2012).
- "GPS Module", Internet: www.iwavesystems.com.
- timesofindia.indiatimes.com/madurai/85fishermenkilled-by-Sri-Lanka-in-10-yearsGovt/articleshow/15540452.cm
- K. Suresh Kumar et al., "Design of low cost maritime boundary identification device using GPS system", International Journal, Vol. 2(9), PP. 46654672,2010.
- M. Diaz, „Integrating GPS receivers into consumer mobile.
- www.isro.org/satellites/satelliteshome.aspx
- www.thehindu.com/multimedia/dynamic/01689/TH_09_GROWING_rev__1689954g
- J-P. Hubaux, S.C Apkun, and J.Luo, "The security and privacy of smart vehicles," IEEE Security & Privacy Magazine, vol. 2, no, 3,pp.49-55, 2004.
- GPS-based vessel position monitoring and display system. Aerospace and Electronic Systems Magazine, IEEE, Jul 1990.