Smart Ship

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Abstract— **Hundreds of the ships are lost every year because of the maritime accidents, insufficient information provided and because of the high economical costs. This paper shows how the current technologies can be used to avoid ship accidents, collisions, contacts between ships and to avoid wrecks. The paper uses a variety of sensors for collecting the data from seas and the data collected with the help of these sensors is stored on the cloud. An android application is used to monitor the ship by using the data stored on cloud. The ship which uses these smart technologies for its functioning is called Smart Ship.**

Keywords— **SmartShips, cloud, mobile application, IoT, Sensor.**

l. INTRODUCTION

It is important to understand what the term Smart Ship [3] means, it can be defined by two ways

- Fully autonomous or
- Remote controlled

In either of the cases the ship can be manned or unmanned. Different solutions are adopted in both the cases. Even in the fully autonomous ships humans are involved in some or the other way to monitor the ship for its safety. A smart ship will be equipped with variety of sensors monitoring the ship and its functions, as well as the surrounding environment and the weather conditions in the area of operation of the ship and the weather forecast. Numerous sensors have been placed for constantly monitoring almost every part of a ship's hull and parts of its machinery as it is essential for a smart ship to discover any irregularity before a failure occurs.

The IoT [1] (Internet of Things) technology helps in combining the data that is collected from the sensors and transfer it to the cloud using Wi-Fi and this makes monitoring of the ship comparatively easy. The ship that makes use of all these technologies for its safe functioning is called a Smart Ship.

II. TYES OF ACCIDENTS COVERED

This paper focuses on reducing the accidents due to:

- *Collision*: Ship lost as a result of striking or being struck by another ship.
- *Contact*: Ship lost as a result of collision with external objects.
- *Wrecked:* Ship lost as a result of touching the sea bottom.

III.   APPROACH USING IOT

Internet of things is basically a system of interrelated devices which can be either mechanical or digital machines and has the ability of computation. It can transfer data over the network without human interaction. In our project, the ultrasonic sensor, temperature sensor, buzzer and an LCD display are connected to the UNO Arduino board[5]. This forms the integrated circuit. A motor driver circuit [13] acts as an interface between Arduino and the motors[12] which control motors. Wi-Fi module [4] is used to give access to the wifi network. These devices are interconnected using jumper wires. Blynk is an android application used to control Arduino over the internet.

A. TEMPERATURE SENSOR

Temperature sensor measures the temperature of water in engine. The temperature sensor used in our project is LM35[7] for experimental purpose. It has two transistors as show in the below figure.

Fig 1. Temperature sensor circuit

One transistor has ten times the area of emitter of another. This means that the transistor has one tenth of the current density. Hence the same amount of current flows through both the transistors. This causes a voltage across resistor R1 which is directly proportional to absolute temperature. The amplifier situated at the top of the circuit takes care of the voltage at Q1 is proportional to absolute temperature(PTAT).This is done by the comparison of output of transistors. The amplifier at the right A2 converts absolute temperature in Kelvin to Celsius .Once the temperature calibrated value is more than the threshold value(>45°), the signal is sent to the buzzer to give an alert through the Arduino.

ULTRASONIC SENSOR

The ultrasonic sensor [14] is used to detect the objects ahead. It emits short and high frequency sound pulses at regular intervals. These waves propagate at the velocity of sound in the air. If an object is ahead, the waves strike the object and are reflected back to the sensor as echo signals as shown in the figure below.
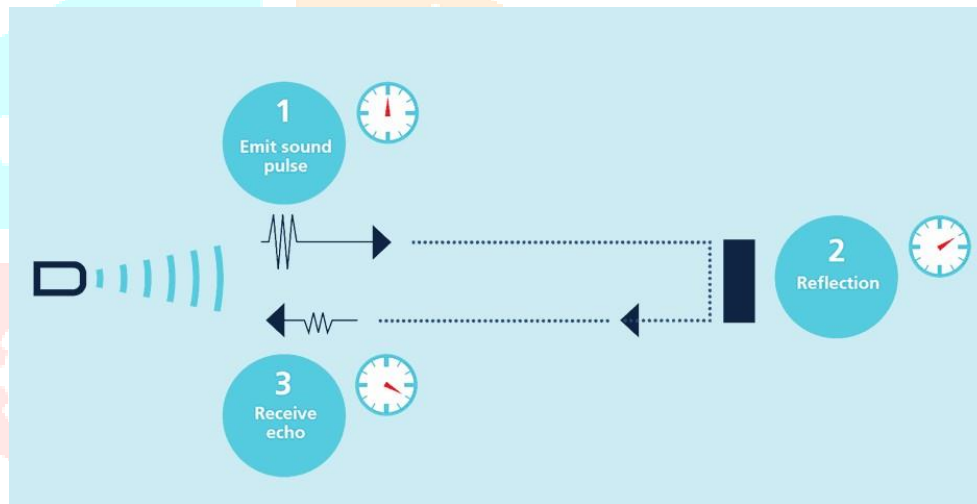

Fig 2. Flow diagram of Ultrasonic sensor

This computes the distance between the object and the sensor location by computing the time-span difference between emitted signal and received signal. Hence if any object is ahead, it'll give the signal to DC motors through the Arduino so as to change the direction to avoid collision. We have used HC-SR04 ultrasonic sensor for experimental purpose in our project which can measure up to a distance of 2cm-4m.

C.   BLYNK APPLICATION

Blynk app allows controlling of hardware remotely. It can get the data from the connected sensors and display through the user interface of the app.
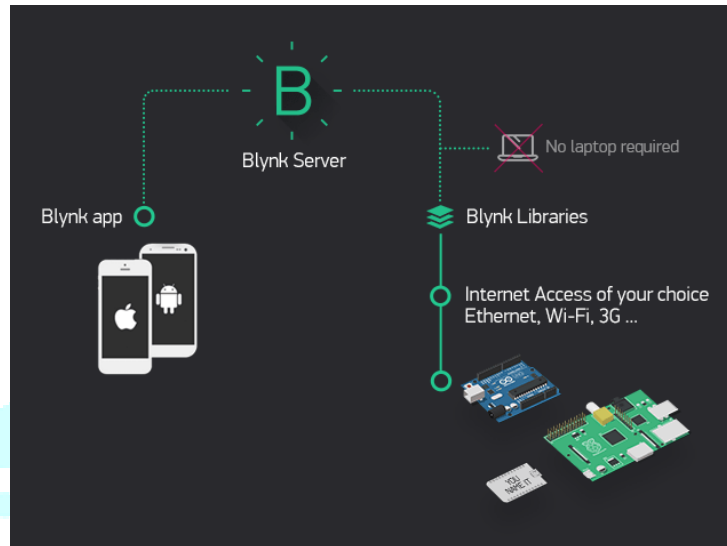

Fig 3. Flow diagram of Blynk Application

It can help in both visualization and storage of data. Blynk server is basically a java server which is responsible for transferring the messages between mobile app and various microcontroller board(ex:Arduino). The Blynk server is a cloud server. Hence the data is stored on cloud. If the temperature is more than the threshold value, an alert message is displayed on the app.It also shows the status of ship whether it is safe or not. If an object is detected or if the temperature is too high, an email is sent to the concerned person so as to take care about the temperature of water.

D.   REQUIREMENTS

- Arduino board
- Buzzer
- Driver Circuit
- Blynk Application
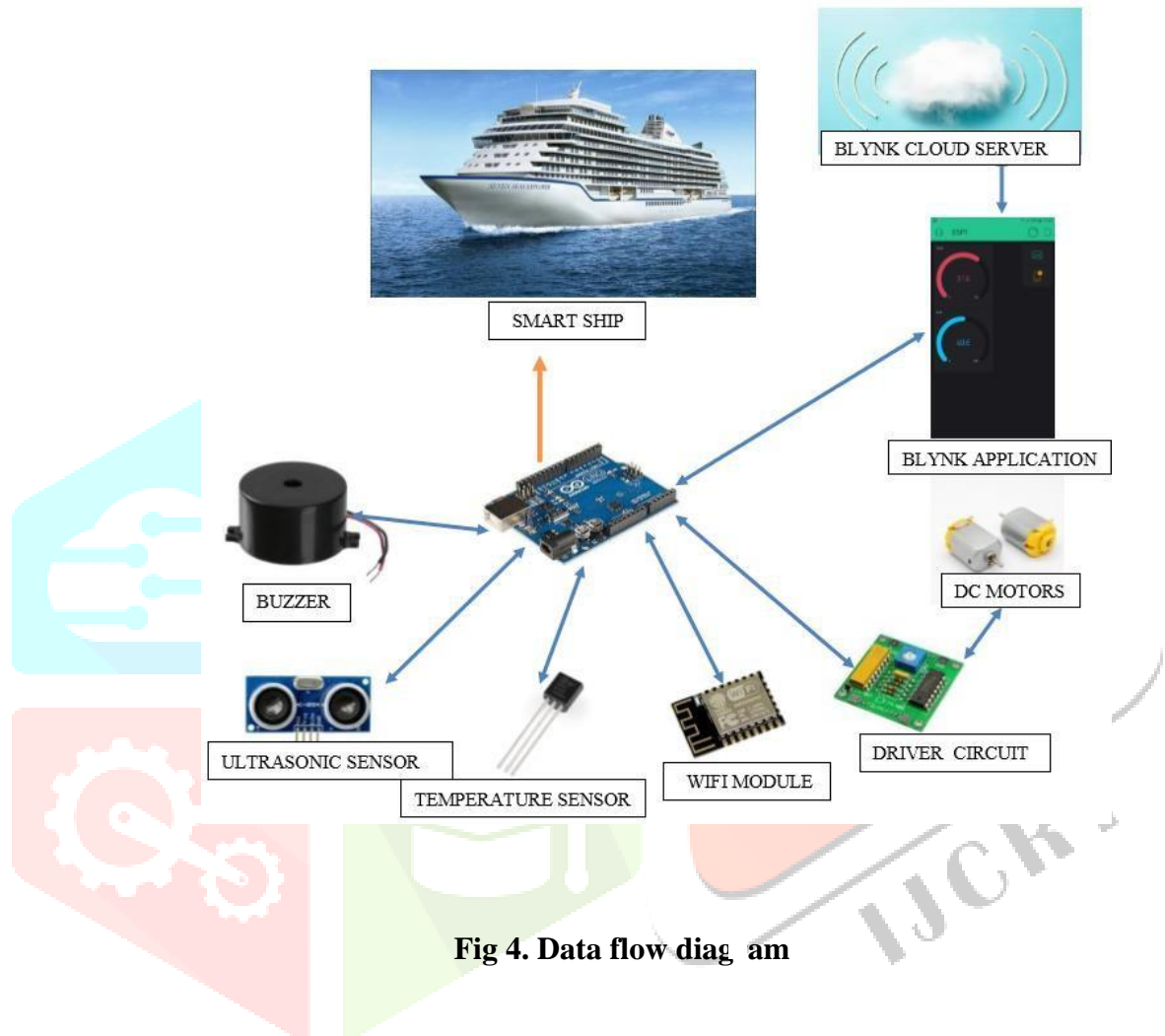
E. FLOW OF DATA

Fig 4. Data flow diagram

The Temperature Sensor senses the temperature of water, when it reaches a certain level where there is a need for the ship to stop, the signal is sent through the Arduino to the buzzer. When the ultrasonic sensor detects that there is an obstacle coming in the way, the information is sent through the Arduino to the motors using driver circuit so that the ship changes its direction. The sensors is also used to measure the distance of the obstacle. We can send all this information to Blynk through WiFi module so that the ship monitoring is made easy.

IV.   CONCLUSION

This paper has shown the successful demonstration of Smart Ship[3] project by using smart technologies such as sensors, cloud and mobile applications. This paper also discusses about the benefits of using these technologies on board in order to prevent maritime accidents. It also has benefits such as on small boats now, it is not necessary to spend a lot of money on marine electronics hence cheap electronics. Applications could use the internet connection to share information of the own ship. Applications to aid to navigation can be implemented, adding algorithm to alert the users about danger situations and avoid collisions. Another advantage is that the application market of smart devices is very wide and dynamic, with a fast growth on applications and developers. Hence a smart ship project can be helpful and user-friendly in marine transport.

V.   FUTURE WORK

The project has a vast scope in future.First is, ultrasonic sensors can only detect whether an object is present or not. It cannot specify what exactly is the object and how does the object look like. Hence ultrasonic sensors can be integrated along with image sensors so as to track the object and find how the object looks like.

The second future enhancement can be, the application interface can be improvised by adding the graphs of the variation of temperature recorded on weekly basis or monthly basis. These recorded data can give an overview of variation to the user.

The third enhancement can be that the application can be added with additional functionality of using map[9]. Whenever the obstacle is detected, the user can be provided with the suggestion of suitable safe path to follow to the users destination. To sum up, many more additional functionalities can be integrated along with the above mentioned functions based on the users requirements.

RESULT

DEMONSTRATION OF THE PROJECT :

TEST CASES :

me of the Sensor	Case	Condition	Status
ltrasonic Sensor	1	Object detected	Switches on Buzzer and changes direction of ship
	2	Object not detected	No Change
Ultrasonic Sensor2	1	Measuring distance	Shows the distance from obstacle on android app
mperature Sensor	1	Temp>45^0 C	Switches on Buzzer
	2	Temp<45^0 C	No Change

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