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Wireless Digital Fuel Level Indicator

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Abstract
In days gone by the petrol level measurement is done by analog meters. It consists of determining the quantity of petrol in the tank at different levels but not accurately. This paper is aimed to design a system to monitor and display the petrol level by using Ultra sonic sensor and a controller. Two different tanks shapes Square, Cylindrical are chosen for the design and measurement purpose. The controller performs the specified task, i.e., displaying the petrol level and the distance vehicle can travel. Vehicles like motorcycles, cars, buses and trucks and equipment such as compressors, generators needs a means of refueling so that it can run to the destination as efficiently as possible. If the equipment is built in with the digital petrol indicator to know how much fuel is left over to reach the destination, and also to know how much fuel to be stored for the safe and secure journey.

Keywords: *Distance, Fuel Indicator, Microcontroller, Round trip time, Ultrasonic sensor, Zigbee*

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INTRODUCTION
The main aim of this project is to determine the petrol level digitally by means of wireless phenomenon; where at times it is difficult for the riders to identify the exact quantity of the petrol and the distance the vehicle can travel with the remaining quantity.

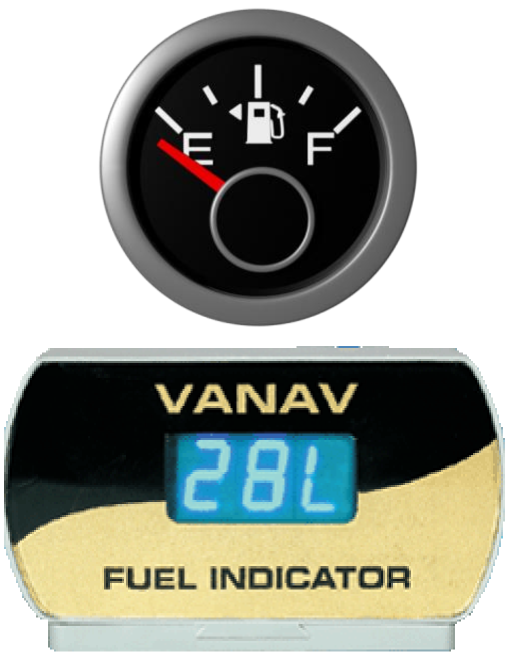

Fig. 1: *Analog Fuel Meter and Digital Fuel Meter.*

The Figure 1 shows the difference between the analog and digital meters in which it is easy to evaluate the exact value of fuel in the tank. Hence it will be more advantageous implementing this wirelessly.

Literature Survey
Literature reviews of available literature source of this work have been performed to ensure more understanding to utilize ultrasonic distance meter. The areas that were engaged are on conduct of ultrasound through journals, books, and web. The proposed framework 'Ultrasonic Range Detector' utilizes an ultrasonic module that comprises of an ultrasonic transmitter and beneficiary alongside microcontroller. It works by transmitting a short pulse of sound at a recurrence indistinct to the ear (ultrasonic sound or ultrasound). Subsequently the microcontroller listens for a reverberation. The time slipped by amid transmission to resound gathering gives data on the separation to the object [1].

The simple and exact estimation of separation has been real subject of study in the field of designing and material science from long time. Utilizing electromagnetic waves for separation estimation accumulated importance with the approach of exploration in the field of electromagnetism [2]. The utilization of infra-red beams exhibits a simple answer for the current inquiry, while the expense of this straightforwardness emerges as a low range and a noteworthy error in the final outcome. The proposed framework utilizes ultrasonic waves for distance estimation. The directional properties of the wave and low attenuation makes it exceedingly suited for distance estimation.

Goal of the proposed technique was to build up a gadget in light of a profoundly that can be utilized to gauge the separation of the objective with high accuracy utilizing controller. Focus has been given on lower ranges considering the scope of 1 cm to 3 m with the precision of ±0.1 cm utilizing standard ultrasonic transducer HC SR04. The objective should be opposite to the course of engendering of the beats. The adequacy of the received signal gets altogether lessened and is a component of nature of the medium and the separation between the transmitter and target. The beat reverberate or time-of-flight technique for extent estimation is liable to elevated amounts of sign lessening when utilized as a part of an air medium, subsequently constraining its distance range.

Broad literature review was directed to decide the most appropriate segments for the framework to be designed. Program code and the equipment configuration were completed in the wake of considering the required framework execution and the imperatives like range temperature. This paper presents a low-cost, low power and straightforward framework for distance estimation. The accuracy of the outcome is high contrasted with other conventional techniques. It is positively a reliable and productive strategy for quick estimation of distance.

Methodology

The model is planned in a manner that the microcontroller is interfaced to the Ultra sonic sensor remotely. The sensor transmits the distance barring the petrol level filled in the tank to the controller. The stature of the tank in which fuel is unfilled is given to the microcontroller. The fluid level is resolved digitally with scientific investigation performed in the controller and the quality is shown on the LCD in liters. A 16X2 LCD will be interfaced to the controller to show the amount of petrol and the average distance the vehicle can travel. Figure 2 demonstrates a block diagram of transmitter and receiver.

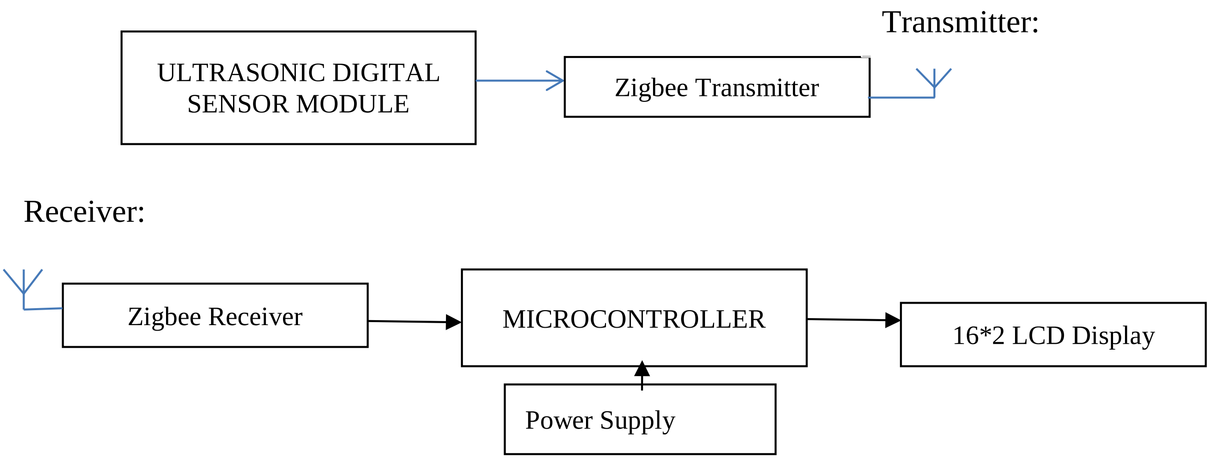

Fig. 2: *Block Diagram of Transmitter and Receiver.*

Ultrasonic sensor is widely used in liquid level measurement. Direction, strength, easy to control, and contact less with the object being measured are the advantages of directional ultrasonic transmitter. In the measurement, ultrasonic pulse from the sensor to the object, reflected by the surface acoustic wave sensor to receive the same after the conversion into electrical signals, then, through the time of transmitting and receiving sound waves to calculate the distance from the sensor to the measured object. The calculations are done by the following way:

The device calculates the time that the ultrasonic wave took to reach the targeted object and back to the receiver. Secondly, the device multiplies the time by the speed of the sound (340 m/s) to get the distance between the device and the object.

The time from transmission of the pulse to reception of the echo is the time taken for the sound energy to travel through the air to the object and back. The block diagram shown in Figure 3 is used for displaying the distance. Since the speed of sound is constant through air, measuring the echo reflection time lets you calculate the distance to the object using this equation:

Distance = (s * t) / 2 (in meters) --- (1)

where, s [m/s] is the speed of sound in air and t [s] is the round trip echo time. The Table 1 shows the echo times and the corresponding distance measured by the sensor.

Table 1: *The Delay Times of Boundary Range*

Round trip echo time	Distance
t = 588 us	10 cm
t = 17.6 ms	3 m

IMPLEMENTATION

PROTUES combines advanced schematic capture, mixed mode SPICE simulation, PCB layout and auto routing to make a complete electronic design system. Protues VSM technology allows simulating microcontroller based design completely with all the surrounding electronic as shown in Figure 4.

Intelligent Schematic Input System (ISIS) lies right at the heart of the PROTUES system and is far more than just another schematic package. It has powerful environment to control most aspects of the drawing appearance.

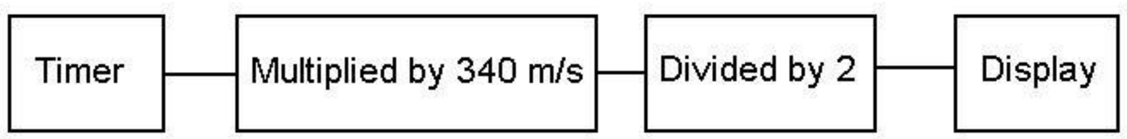

Fig. 3: *General Block Diagram of Sensor.*

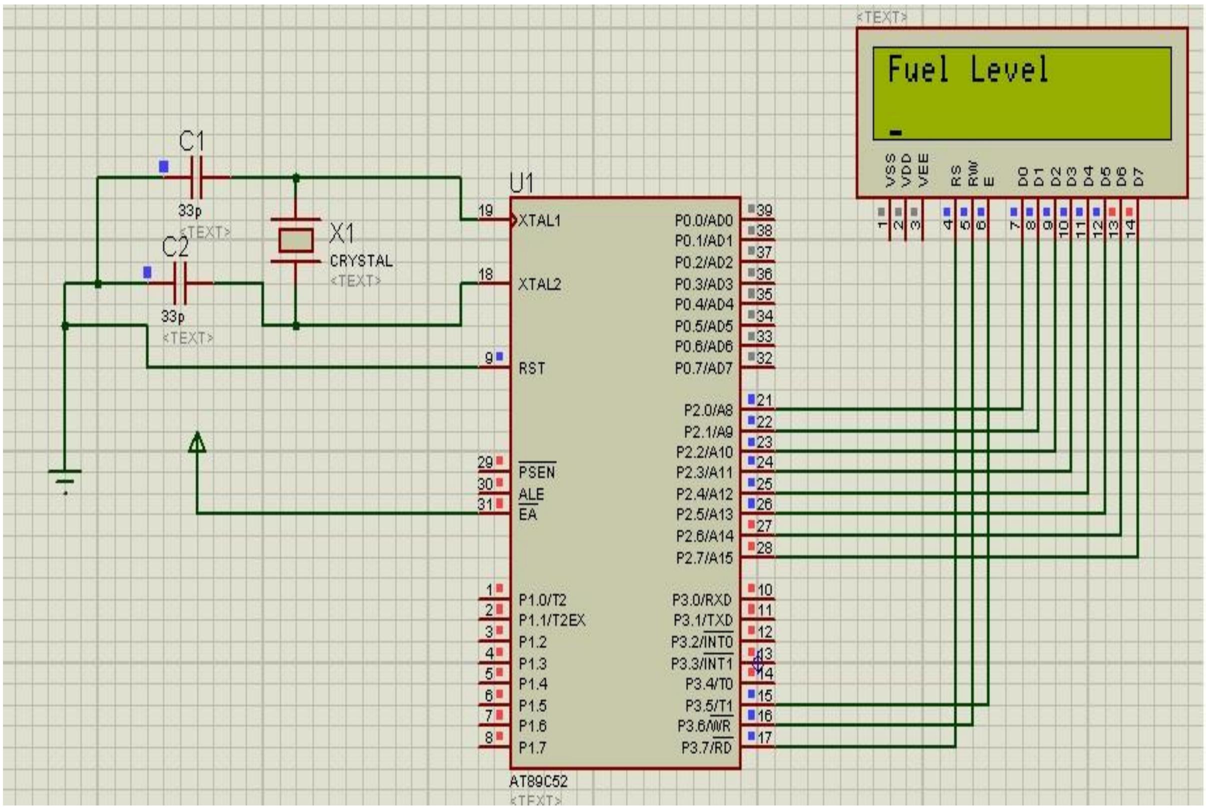

Fig. 4: *Design Prototype in PROTUES.*

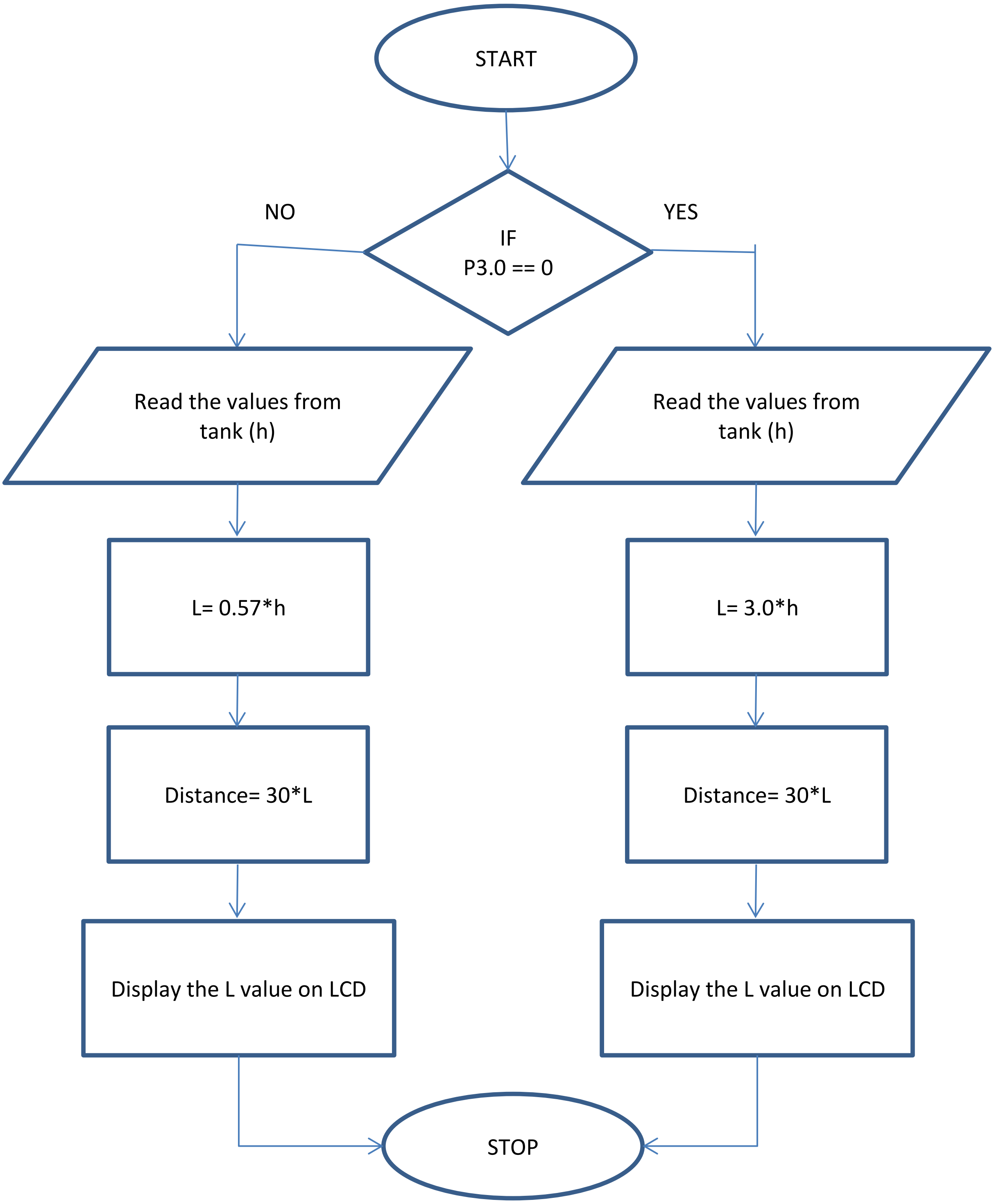

Fig. 5: *Flow Chart of Wireless Digital Fuel Level Indicator.*

Port 3 pin 0 is chosen for the measurement of the tank values. Initially the P3.0 is '0' then tank 2 (Square shaped) is selected and the measurement of fuel in that tank is done. The output of ultrasonic sensor is given to the microcontroller which then calculates the number of liters present in the tank is displayed [3–8]. If the pin 3.0 is '1' then tank 1 (Cylindrical shaped) is selected and the above operation is performed accordingly. The flow chart is shown in the Figure 5.

RESULT

Fuel levels in automobiles are shown in Figures 6 and 7 for two different tanks. The level in the tank and the distance the vehicle can travel is displayed on LCD interfaced to microcontroller.

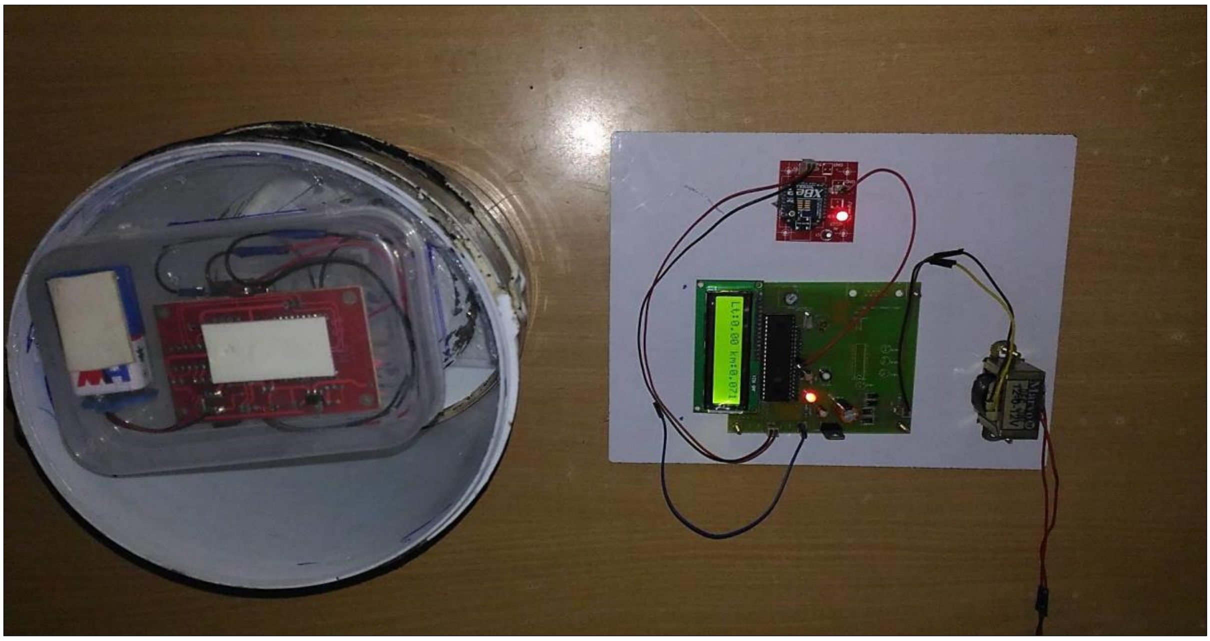

Fig. 6: *Initial Level in the Tank '1'.*

Fig. 7: *Amount of Fuel Level in the Tank '2'.*

Table 2 compares the fuel present in both the tanks theoretically and practically and graph shown in Figure 8 shows accuracy of the measuring device for the practical and theoretical values.

Table 2: *Tabular Column of Both Tanks.*

Height (cm)	Theoretical values (ltrs)		Practical values (ltrs)	
	tank-1	tank-2	tank-1	tank-2
0.1	0.06	0.02	0.06	0.02
1	0.65	0.24	0.64	0.23
5	3.25	1.2	3.22	1.15
10	6.5	2.4	6.42	2.35
20	13	4.8	12.84	4.7

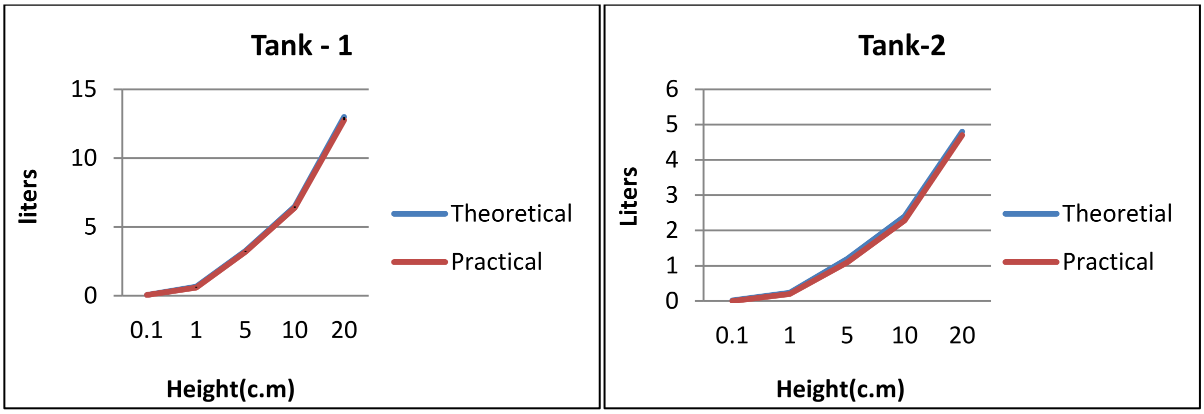

Fig. 8: *Accuracy of the Measuring Device (Theoretical versus Practical Values).*

CONCLUSION

The fuel level is accurately calculated by digital wireless phenomenon using ultrasonic sensor. The proposed technique can be used for particular densities at different altitude conditions of vehicle and a buzzer to announce the user about the abnormal conditions like low level, half level and full levels of the fuel tank. This measuring device can further be enhanced for accurate distance the vehicle can travel with the fuel present in the tank by programming using the microcontroller taking the inputs such as present mileage, speeds, type of roads and tank shapes.

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