



C² : Calamity Companion

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Introduction

To make a device which detects unseen pits during heavy rains or floods. There are ultrasound range sensors in the device which measures the distance of the sensor from the ground. There are two such sensors. The difference of the reading of these sensors is used to predict the depth of the pit during floods.

System Overview

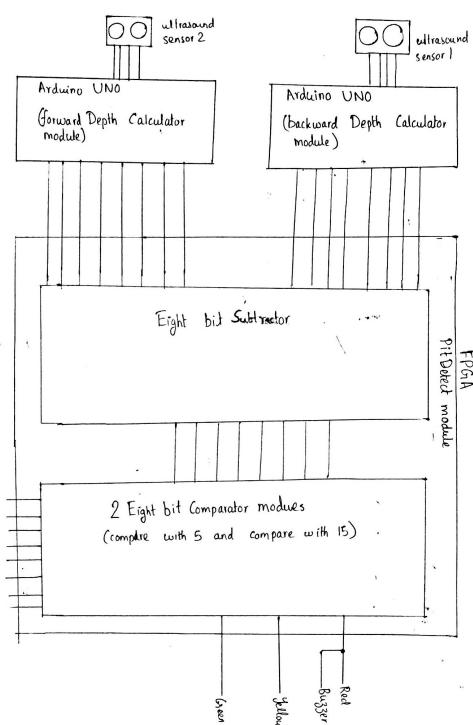


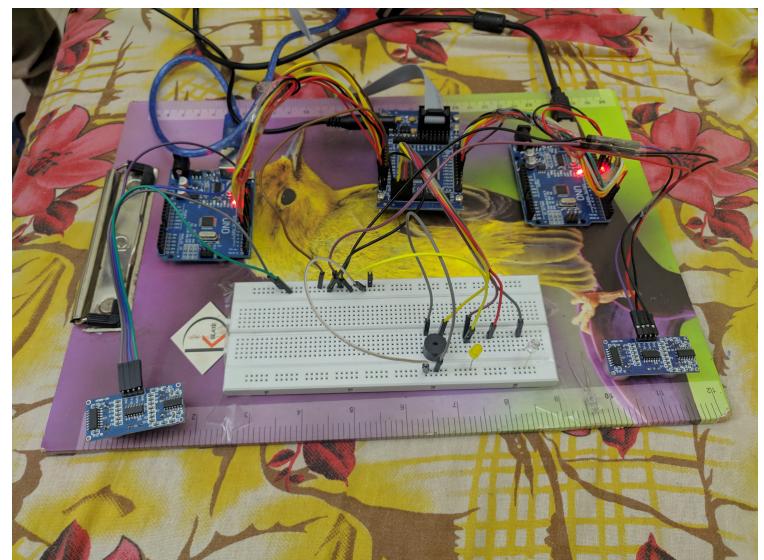
Fig. 1:Block diagram of C²

There are four pins in an ultrasound sensor namely- VCC, GND, Trig, Echo. VCC and GND are connected to 5V, 0V DC supply respectively. A trigger is sent to 'Trig' Pin which is active for $10\mu s$ and then goes OFF for next 250ms. This trigger instructs the transducer to send 8 cycles of Sonic Burst of Ultrasonic Waves. These waves after getting reflected from the ground or obstacle are received by the receiver which activates pulse PIN until Trigger is ON. By this, We can find out reflection time. On multiplying this reflection time with speed of sound, We get the distance of obstacle from Ultrasound sensors.

Implementation Details

In this project, there is an FPGA Board which has two 8 bit inputs, from the Arduino UNO board. Two Arduino UNO boards are connected to two ultrasound sensors respectively. These Ultrasound range sensors give the respective outputs in centimeters to the Arduino boards. There is a module named forwardDepthCalculator which takes the output of the Ultrasound range sensor as its input and then calculates the depth in binary for the leading sensor. Another module named backwardDepthCalculator does the same for the trailing sensor. Now, the output of these two Arduino boards is fed as the input of the FPGA board in the PitDetect module which is the top-level-entity of our project. Now, this PitDetect sends these inputs to another module namely EightBitSubtractor which calculates the depth (in binary) of the pit by taking the difference between leading and trailing sensor outputs. Now another module namely EightBitComparator is called in the main module, which compares this depth with the predefined safety levels. Using this data the main module indicates the user about the pit on the road ahead and accordingly glows the LEDs and buzzers.

Results



If the depth of the pit is greater than 15cms then the red LED along with buzzer is turned on which alerts the user to change his/her path. If the depth of the pit is between 5 to 15 cms then the yellow LED turns on indicating to slow down the vehicle. If the depth is less than 5 cms , then there is no problem and the green LED indicates that.

Conclusion

With the help of our project , we are able to predict the pits which helps the vehicle safely navigate in the case of floods. The prototype is working and has been tested for all possible practical cases.

References

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- [3] <https://components101.com/ultrasonic-sensor-working-pinout-datasheet>