USER'S MANUAL

Level measuring system with web interface

Instituto Superior de Engenharia do Porto

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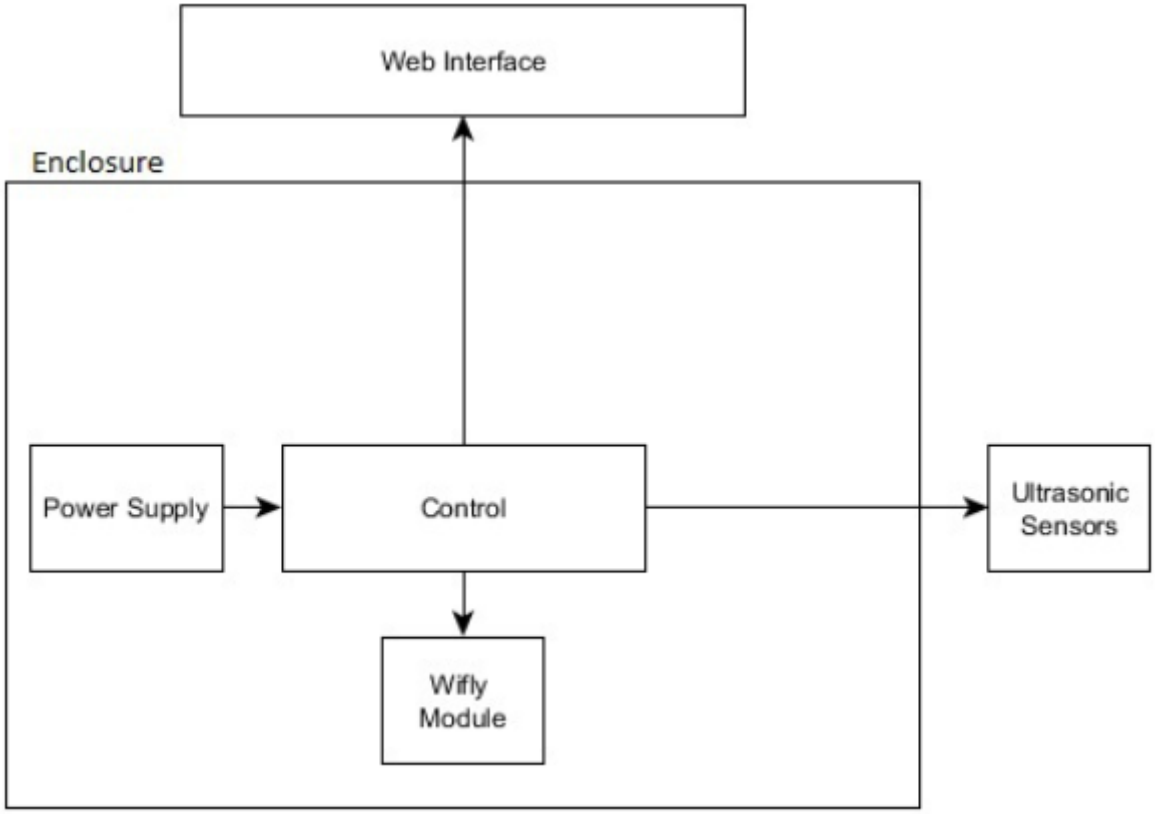
1. GENERAL INFORMATION

1.1. System Overview

Our height/level measuring system is capable of measuring the fullness of a container. It can also upload this information to a web server via a wifi connection and this way someone can always monitor the state of every container equipped with this system.



Everything was design in order to make it simple and user friendly.

1.4. Points of Contact

1.4.1. Help Desk

Contacts

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2. SYSTEM SUMMARY

This is how our system should look like after being installed inside the container. It consists in two simple parts, the ultrasonic sensors installed on top of the container and the controller box containing all the other parts.

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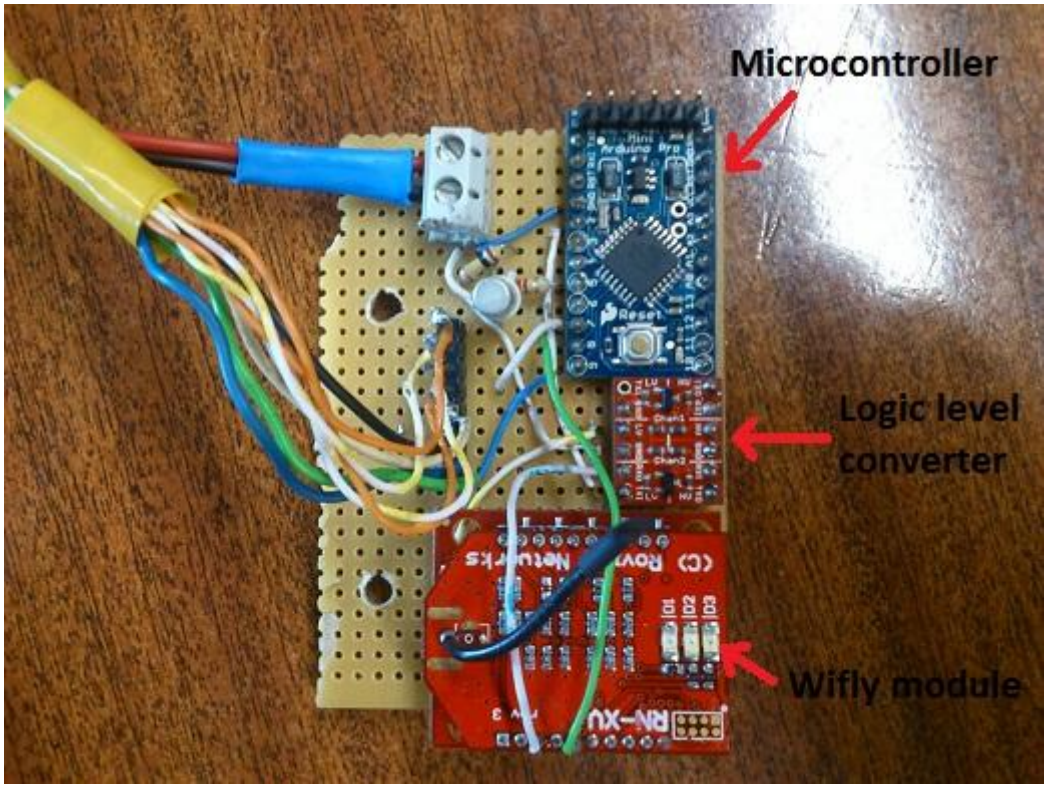
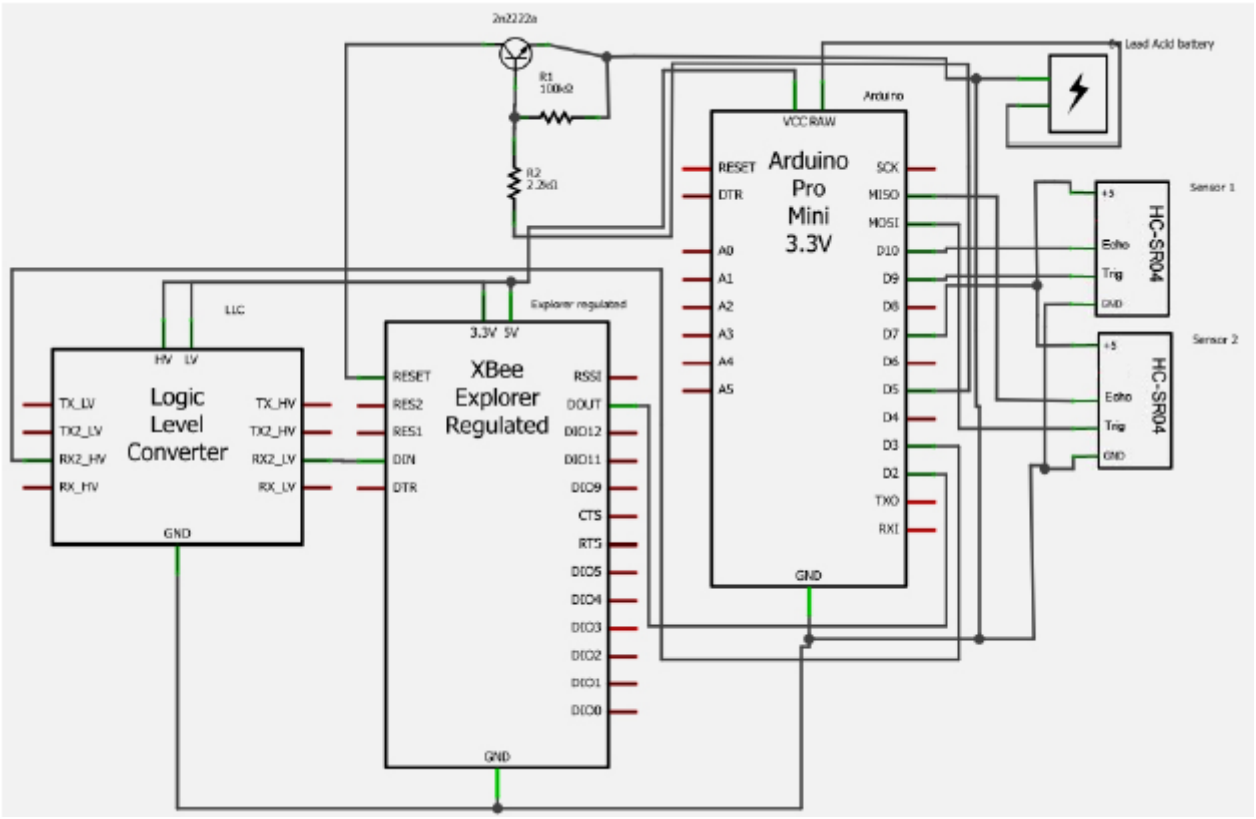
Inside the controller box we have the battery, the microcontroller and the wifly module providing a connection to the web server.



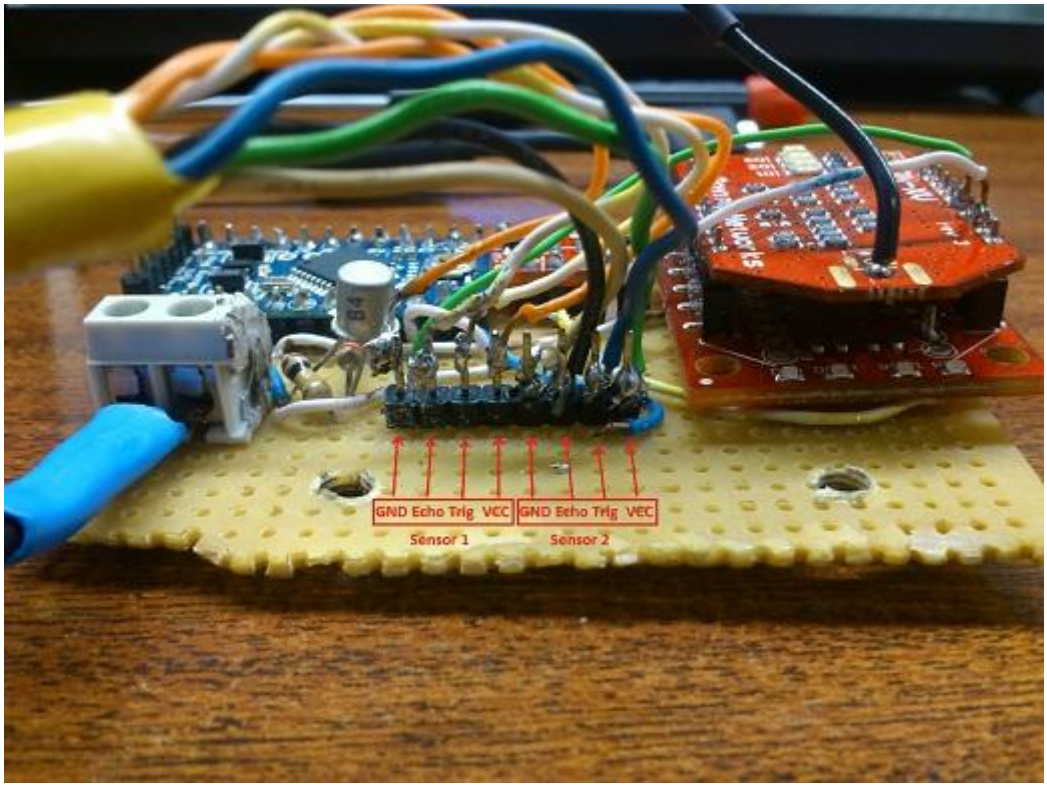
The schematics of the system are quite simple and are shown above.



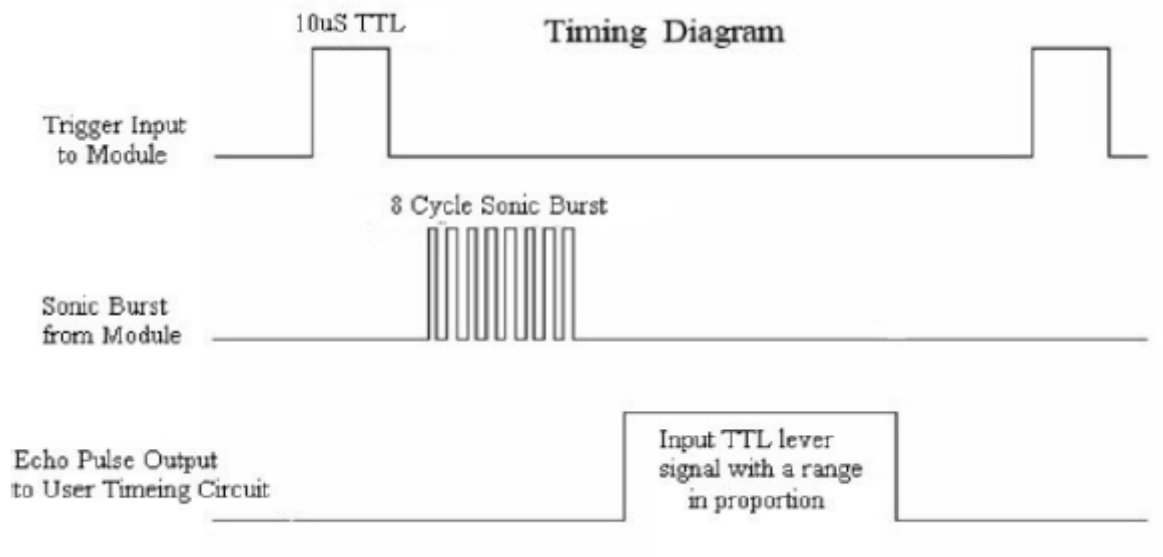
The ultrasonic sensors installed on our system provide 2 cm to 400 cm non-contact measurement function, the ranging accuracy can reach up to 3 mm. The modules include ultrasonic transmitters, receivers and a control circuit.The IO trigger is set for at least 10 us high-level signal and the Module automatically sends eight 40 kHz ultrasonic waves and detects whether there is a pulse signal back.

If the signal returns it will output a high signal and the duration is the time from sending to the returning of the ultrasonic signal.

The pinout of the ultrasonic sensors is shown below.



This diagram shows what happens, in terms of signals, during the measuring time.



The microcontroller will process this values and send them via wifi connection. The wifi module wakes up and automatically connects to the presetted access point to send the data.

The user can access to the container status via a web page where all values are displayed.

This is the main web page, and on this page we have two options, we can check the container status and also change some of the container settings.

The web server receives the sensor values from each container and processes those values accordingly to the settings the user has defined and shows the fullness of the container in percentage.

This is one example of the webpage showing the container status, its fullness and also each sensor values at a given measuring time.

Container status

Settings

Bottom to sensor hight: 150 cm
Max level to sensor hight:29cm

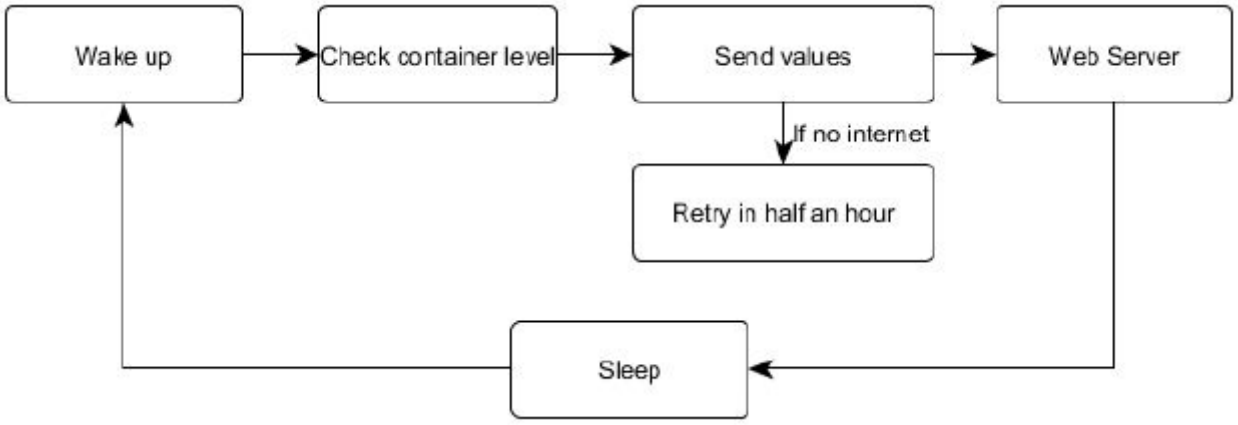
Sensor values at: 14:15:57 - 12/06/2012

Sensor 1: 50 cm
Sensor 2: 51cm

Container status (%): 82,2%

Back

2.2. Data Flows



This diagram shows the basic system function, after the system checks the container level the data is processed and sent via wifly after this all the values are reseted inside the microcontroller but in the web server this values are saved in a text file for later use.

3. GETTING STARTED

This section provides a general walkthrough of the system from initiation through exit. The user should read it carefully in order to understand and comprehend what is explained step by step.

3.1 Installation

3.1.1 Ultrasonic sensors

The ultrasonic sensor should be installed in the top of the container with a minimum distance of 2 cm from the sensors to the top of the container. They should also be in line with the center of the container and the sensors "face" should be parallel to the container bottom.

3.1.2. Enclosure/controller box

The enclosure box can be installed anywhere inside the container as long it is safe from the items that can be thrown inside the container. It should be placed in a way no one without access to the inside of the container can reach it or touch it somehow.

3.2. Configuration

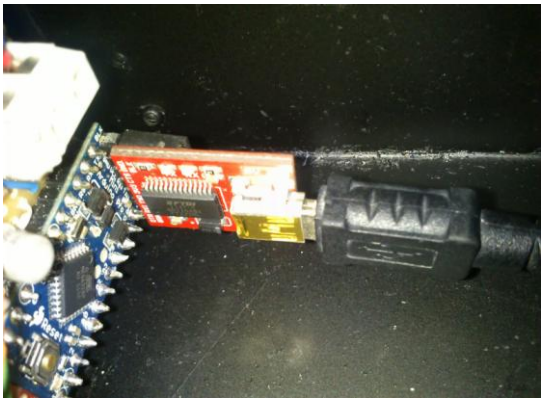
3.2.1 Microcontroller

We provide the microcontroller source code which is customizable.

```
/*############- CONFIGURATION -########################### */
/* WiFi network SSID and Password */
const char mySSID[] = "DEE-Wlan";
const char myPassword[] = "Isep-Dee-Wlan-2010";
const char site[] = "10.0.15.226";/* IP or url for sending the sensor values */
int set_sleeptime_hours= 12; // in this case 12 hours sleep time
/*############- END OF CONFIGURATION -################### */
```

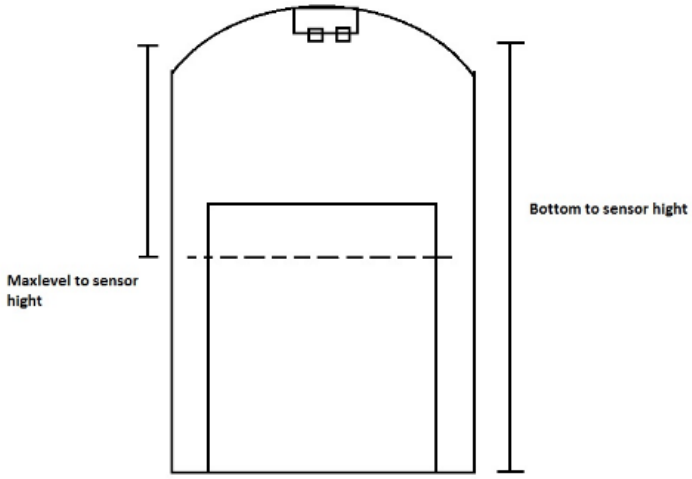
This are the only variables that should be changed accordingly to the user needs. First we have the network/access point SSID and password. The website can be set in IP address

To connect a computer to the microcontroller a USB A to Mini-B cable is used and and also a FTDI Basic Breakout - 5V to program it using the arduino ide. It should be connected like the picture below.



3.2.2 . Web Server

The web server configuration only has two options which are the max level to sensor height and the bottom to sensor height and with this two options we can configure the system to work with different types of containers and also different sensor placement configurations.



Container settings

Bottom-sensor hight: cm
Maxlevel-sensor hight: cm

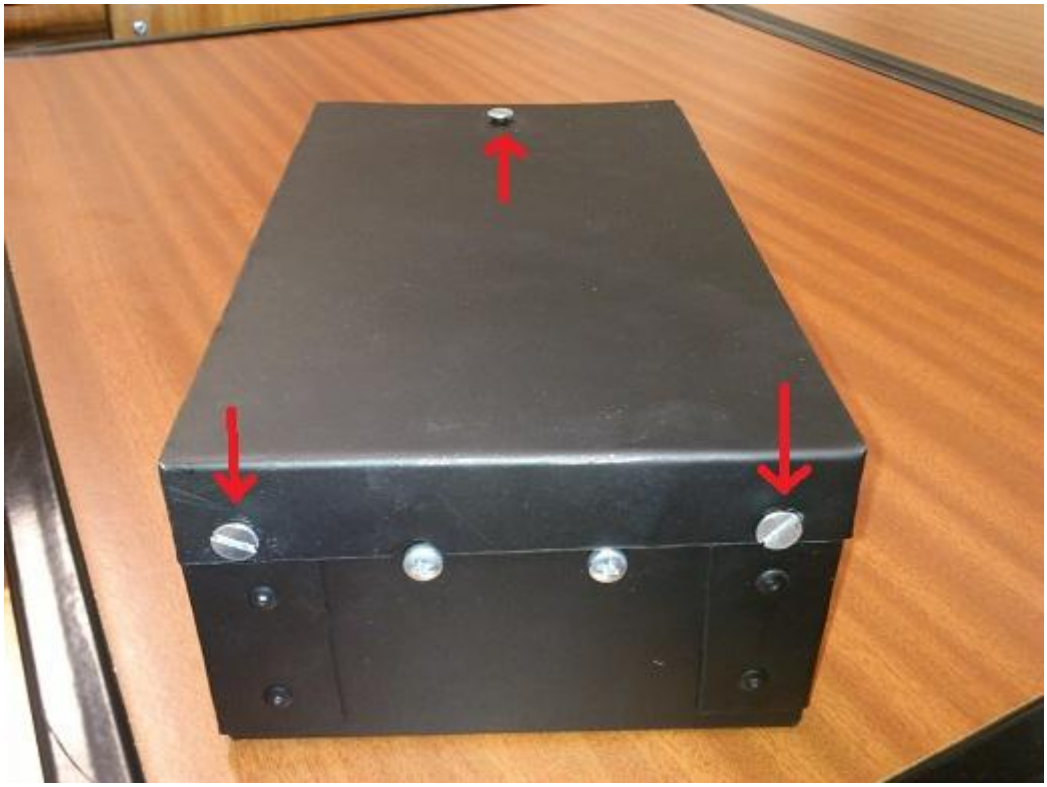
Submit

3.3. Maintenance

Our system was designed to work autonomously but it also needs maintenance, specially the battery. The system needs battery replacements every 6-7 months and every time the battery should be fully charged. Each lead-acid battery should last approximately 200 to 300 charges which translates in more than 100 years of working time. The system could last more than 7 months but it is not recommended to let the battery fully discharge and for that matter we advise to replace batteries every 7 months.

Each battery can be reused again instead of being disposed after discharge.

For the enclosure, there are only 3 screws securing the box lid which are easy to unscrew and after that the box can easily be opened. The screws are shown in the picture below.



To remove the battery, it is possible to just remove it out of the box and only after remove the battery cables, this has to be done carefully not to harm the control system just next to it.

The old battery should be replaced by another one of same size.