

ABSTRACT

Our country, Italy, has a high seismic hazard on almost the whole territory. This fact, combined with a high house density and very old buildings, causes a raised seismic risk. It is important to mitigate this risk in order to minimise the effects of earthquakes.

The aim of this project is to reduce factors of risk in supermarkets, which are highly frequented places. In a lot of aisles there are shelves full of bottles and jars made of glass or plastic, which might fall during an earthquake and thus cause serious damage to people and things.

In order to prevent this, we have developed a device that could make the shelves safe. It has a plastic strip that is set in motion by a simple low-voltage circuit, steered by an Arduino board provided with an accelerometer. When an earthquake occurs, the accelerometer informs the Arduino board, so the circuit activates the release of the strip: it comes down and prevents objects from falling off the shelf.

The prototype turned out to be effective. This device is cheap and easy to be fixed and to be replaced after use.

INTRODUCTION

Friuli Venezia Giulia is an Italian region with a high seismic hazard, and about 40 years ago it was heavily struck by a catastrophic earthquake. In spite of this, the level of public awareness regarding seismic hazard is quite low. With the precise aim to make students more aware and informed about this issue, our school has promoted several activities concerning seismic safety. The project S4 was born as a part of this framework.

PROJECT AIMS

- To lower seismic risk in supermarkets, where there is a lot of heavy and fragile stuff that could fall down and cause damage.
- To develop a handy, cheap, versatile and safe solution.
- To promote seismic prevention and safety.



Earthquake in Gemona del Friuli in 1976

<http://www.udinetoday.it/foto/cronaca/terremoto-del-friuli-1976-le-immagini-del-sisma/tf7.html>


Photograph by di Elisa Contessi

SHELVES-KEEPER DEVICE

After the first planning phase, we built our prototype: a metal frame is fixed with two screws onto a two-layer shelf, in the front. A narrow plastic bar hangs from the frame and two thin aluminium arms link the bar to the frame. At one end of the bar there is a neodymium magnet and on the other end it is fixed to a tape, hooked by a pivot to the shelf standard. The Arduino board continuously reads the signals sent by the accelerometer. If an earthquake occurs, the board turns on the release unit, and thus lets the bar swing into its position and come down. Now the bar is attached to the standard through the magnet and the tape is kept in tension. In this way the device prevents objects from falling off the shelf.

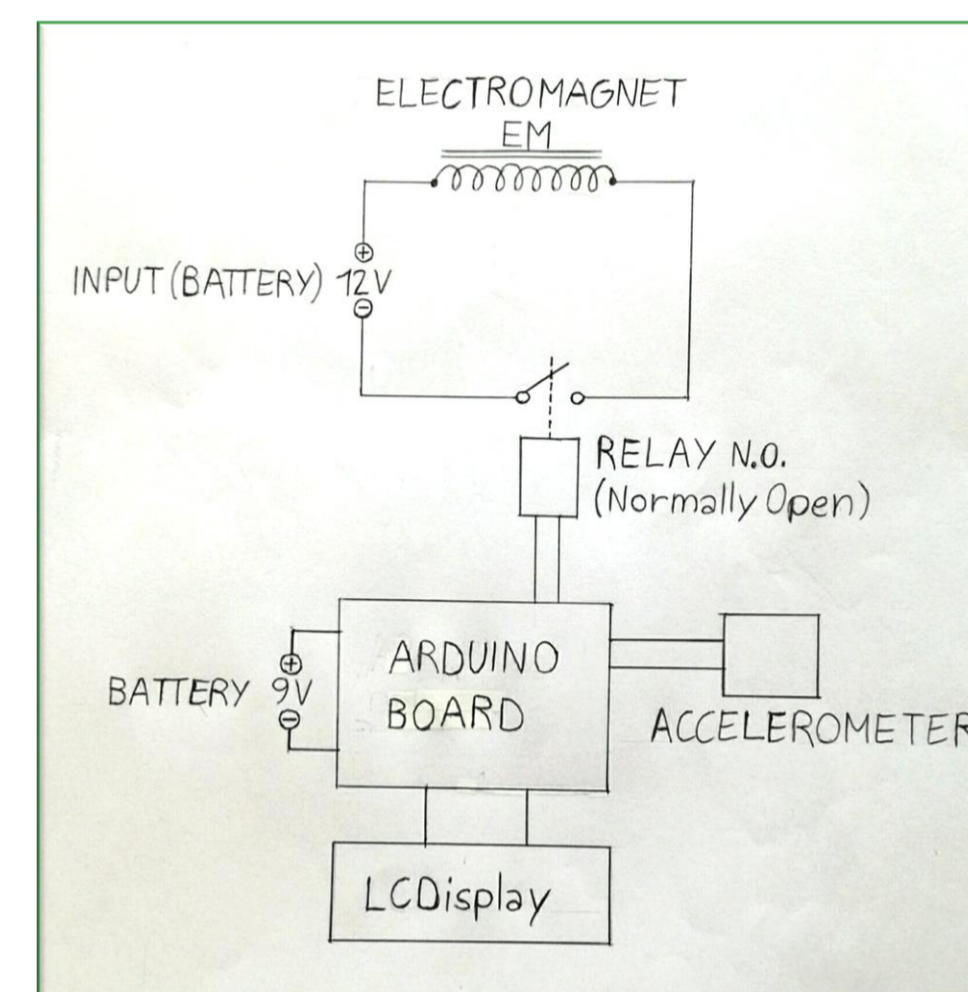
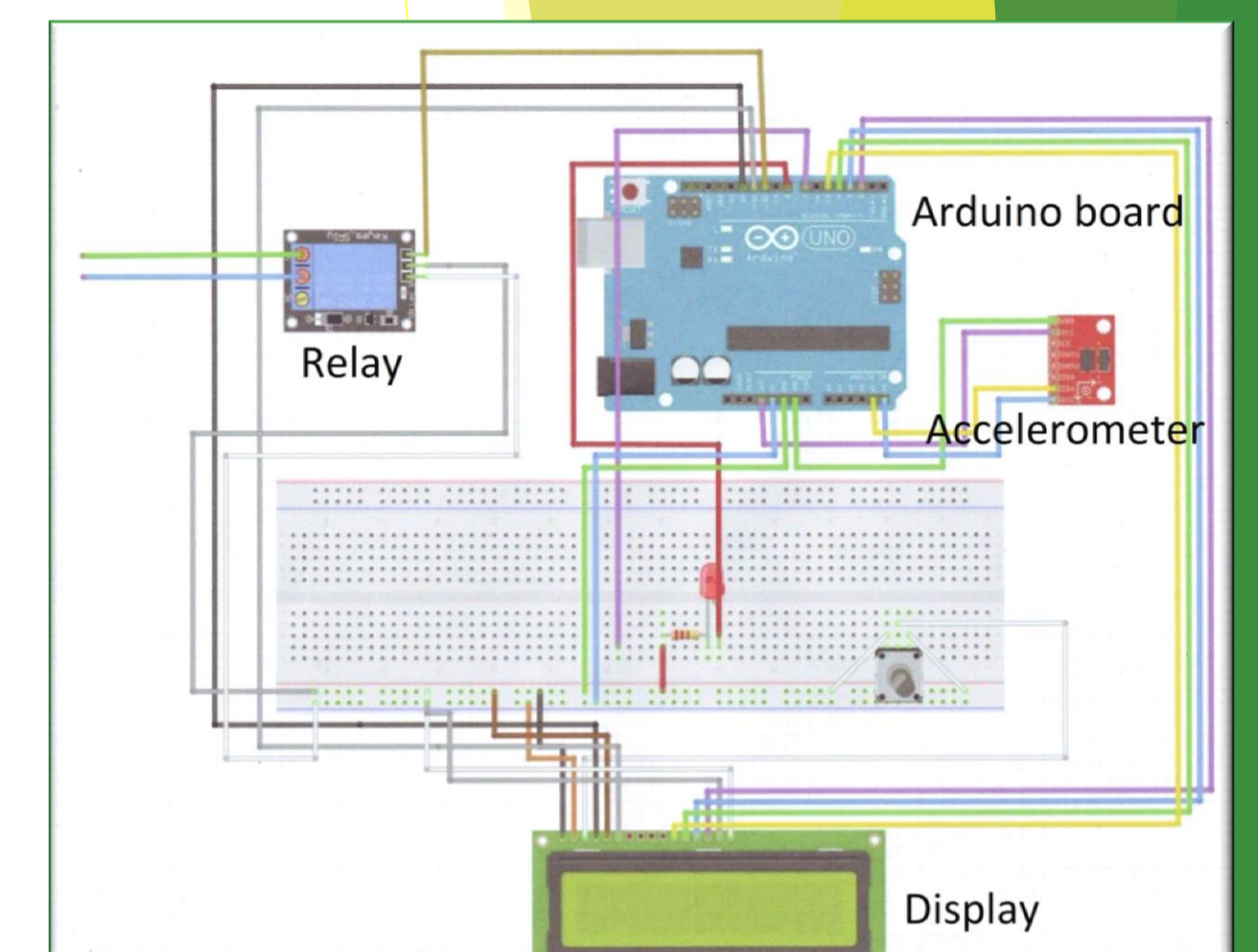


Image by Luca Pellegrini



Scheme by Clarissa Ciani

DATA SHEET

Components of the shelves-keeper device

- acceleration sensor MPU-6050 (GY-521)
 - Arduino UNO board
 - relay SDR-05VDC-3L
 - electromagnet* Sourcingmap Dc 4.5V 0.75A 3.38W
 - neodymium magnet*
 - LCD display RG1602A
 - 9V battery (to power the Arduino board)
 - 12V battery (to power the electromagnet)*
 - consumables (electrical cables, screws, welding)
 - steel frame*
 - aluminium strips, plastic bar, tape*
- (*components to be applied to each shelf at risk)



Photograph by di Elisa Contessi



Prototype by Michele Andreussi

CONCLUSIONS

Seismic safety does not mean only anti-seismic building or fixing the furniture to the walls: it is necessary to take risk factors out of the places where we daily live. For instance, shelves in supermarkets should not be a cause of danger. And that is the true aim of our project.

The device we developed is simple, effective and cheap. It is easy to be fixed and to be replaced after use. It is suitable for all types of shelf and could be installed, with the proper settings, in supermarkets but also in pubs, storehouses and homes. A single control unit can run all the linked shelves.

This device can effectively contribute to prevention. It could be applied in Italy as well as in other countries where earthquakes often occur.

Our dream: to develop the Safe Shelves kit, available for all kinds of shelves and also in household environment!

REFERENCES

- AA.VV., Il Rischio Sismico, a cura di Enzo Boschi. Le Scienze quaderni, n°59, aprile 1991.
- AA.VV., Terremoti: come e perché. Itinerari per la riduzione del rischio sismico. Giunti, Firenze, 2005.
- C. Barnaba, E. Contessi, M.R. Girardi (a cura di), PRESS40 - PREvenzione Sismica nella Scuola a 40 anni dal terremoto del Friuli. Resoconto di un'esperienza sismologica, Gaspari, Udine 2017.
- L. Peruzza, A. Saraò, C. Barnaba, P.L. Bragato, A. Dusi, S. Grimaz, P. Malisan, M. Mucciarelli, D. Zulliani, C. Cravos, Teach & Learn seismic safety at high school: the SISIFO project, Boll. Geof. Teor. Appl., 57, 129-146, 2016. <http://www.crs.inogs.it/>
- <http://www.ingv.it/>
- <http://www.protezionecivile.fvg.it/>
- <https://www.youtube.com/watch?v=3woP0ACjias>
- <http://microcontrollerslab.com/earthquake-detector-arduino/>

SEISM



Prototype by Michele Andreussi