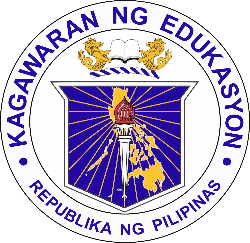
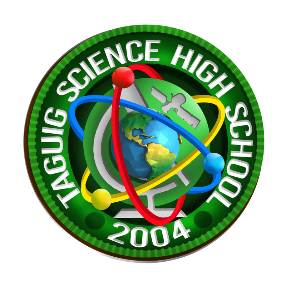
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**Disaster Alert Box: Portable home device**

**for disaster detection interfaced**

**with alert messaging system**

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**Abstract**

With the Philippines facing the issue of being one of the most prone to disaster countries in the world, a strong need of a solution lingers across the nation. The government’s action plan does not suffice in the full execution of disaster prevention, mitigation, response, and rehabilitation. Civic interaction is lacking despite it being a must. But along with the rise of modern-day tech integrating itself into people’s daily life comes the emergence of innovative disaster risk reduction (DRR) solutions and machinations essential in accomplishing the task of ensuring safety to the citizens of the country. Following through with the modernization of technology and the Strategic National Action Plan (SNAP) for DRR, the researchers contrived the Disaster Alert Box (DAX) which entails all the common home disasters possible such as fire, flood, earthquake, and even theft. Composing of a DHT11 Humidity and Temperature Sensor, Arduino Water Level Sensor, PIR Motion Sensor, MQ-2 Gas Sensor, SW-420 Vibration Sensor, and SIM800L GSM Module, the project prototype-innovation is capable of detecting various onsets of disasters and has an alert function which notifies the user of the detected anomaly via SMS or through a buzzer. With the extra feature of appealing design fitted to the interior decor of a house, DAX holds a potential to pave the way towards future creative home furniture ideas, those of which serve as a means for DRR. Provided that DAX was constructed on a limited budget, this project prototype still has lots of room for development in various aspects such as materials used and sensors. If given better funding, better parts and wares could have been purchased and used to provide more accurate, more efficient, and faster results.

**Introduction**

The Philippines ranks third on the World Risk Index (WRI) based on the United Nations University’s Institute for Environment and Human Security 2017 World Risk Report, which indicates "the risk of disaster in consequence of extreme natural events" in 171 countries around the world. Due to its location along the Pacific typhoon belt and Ring of Fire – a large Pacific Ocean region where many of Earth’s volcanic eruptions and earthquakes occur –, the Philippines also ranks third on the WRI’s list of countries with the greatest exposure to natural disasters, having a score of 52.46% (Mucke, 2017).

Although the national government is dedicated in providing the best means of disaster prevention, mitigation, preparedness, and rehabilitation, the individual performance of local government units (LGUs) working with their assigned communities holds a challenge for the clean execution of institutional mechanisms implemented by higher authorities on Disaster Risk Reduction (DRR).

Following the emergence of modern-day technologies, disaster detection systems and disaster response apparatuses poses as key to the challenge of providing an efficient countermeasure to the rising amount of disasters set in the country with respect to its allocated funding. With modern tech increasingly becoming a key attribute of people’s daily lives, developing the technology for disaster risk reduction to better comprehend, evaluate, and reduce risk will allow for the country and its citizens to become better prepared and take more optimal corrective and preventive actions.

As put by Dr. Young-Seok Kim, Director of Institute of Disaster Management and Public Safety, POSTECH (2016), there are numerous disaster risk reduction (DRR) technologies. However, technology and development will fail if civic participation is not core.

With this, the researchers opted to create a device fitted to the modern world of gadgets and innovations that is capable of following through with the Philippine government’s policies, plans, and statements for disaster risk reduction.

Following on the issue of DRR technology utilization among the citizens, the researchers contrived the innovative project, Disaster Alert Box (DAX).

**What is DAX?**

* DAX is an innovative project stemming on the idea of Internet of Things (IoT) technology specifically purposed to:

- correspond to the Strategic National Action Plan (SNAP) for disaster risk reduction in the Philippines (particularly on disaster mitigation);

- monitor the onset of various naturally occurring disasters i.e. earthquakes, floods;

- detect potential intruders in the absence of the owner or a guardian;

- serve as an alarm system for when the onset of the disaster occurs during moments unanticipated (e.g. user/s is/are asleep, pre-occupied, or imperceptive of their environment);

- send an alert message to the user/owner through the use of SMS during the onset of a disaster or detection of an intruder;

- contact emergency lines specialized in responding to the specific anomaly/ies detected by the device;

- and contribute to improving the overall look/design of the user’s home or establishment

The advent of new technologies marks the go signal for developmental progression on a global scale. With the milestones present in this modern-day era, the researchers aspire to step up and take on the ever-growing challenges brought about by the disaster continuum of their country. With DAX, the researchers hope to have paved the way towards a safer and better-equipped Philippines.

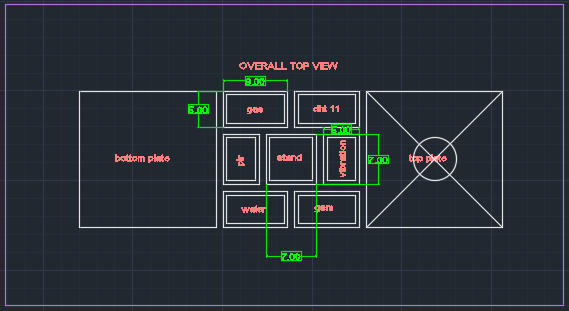
**Methodology and Project Cost**

Given a limited finance and programming expertise, the parts and design used were constrained to a budget-restricted amount specifically intended to accomplish constructing a prototype version of the research project.

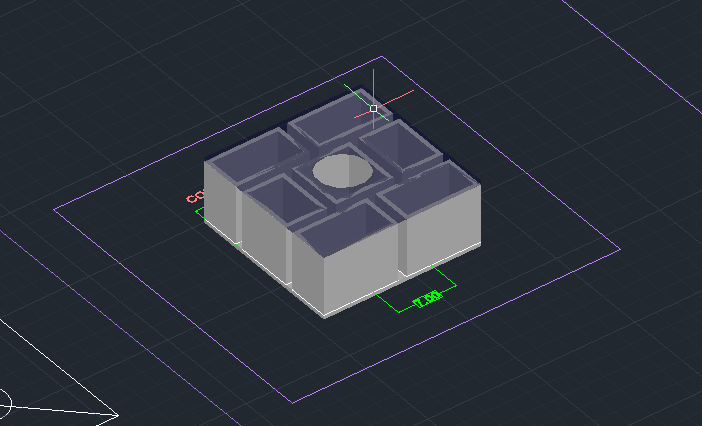
|  |  |
| --- | --- |
| Material | Price |
|  |  |
| 1. Sensors and Modules |  |
| SIM800L GSM Module | PHP 777.00 |
| MQ-135 Air Quality / Hazardous Gas Sensor Module | PHP 205.00 |
| SW - 420 Vibration Sensor Module | PHP 125.00 |
| DHT11 Temperature and Relative Humidity Sensor | PHP 166.00 |
| PIR motion sensor | PHP305.00 |
| Water level sensor | PHP180.00 |
|  |  |
| 1. Spare Parts | PHP 669.00 |
| Buzzer  Bolts and Nuts  Wires  Soldering lead |  |
|  |  |
| 1. Design Materials | PHP 400.00 |
| Silicone sealant Super glue  Sticker paper Sand Paper  Print costs Velcro |  |
|  |  |
| 1. Maintenance and Load | PHP 500.00 |
|  |  |
| 1. Lithium Polymer Battery | PHP 680.00 |
|  |  |
| 1. Shipping Fees and Miscellaneous | PHP 500.00 |
|  |  |
| TOTAL | PHP 4, 507.00 |

*Table 1. Project Cost*

The researchers initiated the construction of the device by first modelling it using AutoCAD to create a simulated version of how the project would look like upon completion.



*Figure 1. Conceptual Dissection*



*Figure 2. Conceptual Assembly*

The researchers then proceeded to cut out the required pieces, with acrylic glass being the material, polish them, then apply the extra key features which add to the overall functionality and convenience of the device (adhesive velcro for detaching of individual casings).

The disaster risk reduction technology used were various Arduino compatible sensors and modules utilized in reading attributed properties such as humidity, gas content in parts per million (ppm), and temperature in small-scale environments and a GSM Module built for SMS messaging.

Arduino ATX2 was the microcontroller board used and Arduino was the programming software utilized to code and calibrate the sensors and modules. The following were the DRR technologies integrated and their respective purpose in the project:

* DHT11 Humidity and Temperature Sensor - the DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

In the project prototype, this sensor was programmed with the purpose of reading the surrounding humidity value and temperature such that it would be capable of detecting a presence of extreme heat in the vicinity translating to either an indication of fire or a cause for heat stress. Upon detection, an alert message will be sent to the user to inform them of the matter via SMS.

* Arduino Water Level Sensor – the Water Level sensor is an easy-to-use and low cost level/drop recognition sensor. The sensor works through a series of exposed parallel traces on board which produces electrical variations when drops of water volume changes. These changes in output voltage determine the current water level.

Serving as a basic water level recognition device, this sensor was employed in the project as a means of flood detection with the aid of SMS for alert messaging.

* PIR Motion Sensor - PIR Motion Sensor detects motion, almost always used to detect whether a human has moved in or out of the sensors range. It is small, inexpensive, low-power, easy to use and does not easily wear out. For that reason it is commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

With the growth of better firmware and other technologies designed to combat theft and other common crimes, the researchers integrated this device in order to strengthen basic home security by alerting users of potential intruders or thieves through SMS.

* MQ-2 Gas Sensor - the MQ-2 gas sensor can detect or measure gases like LPG, alcohol, propane, hydrogen, carbon monoxide, and even methane. It is devised for air quality monitoring systems, gas leak alarm mechanisms, safety standard maintenance units, and for maintaining environment standards in hospitals.

With fire incidents in the country increasing based off of BFP records from 2012-2017, having these types of sensors is an integral step in the prevention and mitigation of fire occurrences in the country, be it in the private class or the public sector.

* SW-420 Vibration Sensor - the SW-420 vibration sensor module produces logic states depending on vibration and external force applied on it. When there is no vibration this module gives logic LOW output. When it feels vibration then output of this module goes to logic HIGH. The working bias of this circuit is between 3.3V to 5V DC.

The vibration sensor is capable of picking up higher magnitudes of shaking which will trigger the alert system interfaced in the project prototype.

* SIM800L GSM Module - the SIM800 or SIM800L V2 5V Wireless GSM GPRS Module has the ability to send messages, make a call or transfer data over GPRS. It Supports Quad-band 850/900/1800/1900 MHz, which can transmit voice calls, SMS messages and low power data.

This module is the key for SMS interfacing of other sensors in the project. Through this, the user is able to save their phone number for contact purposes and receive alert messages in the case of anomaly detection via SMS.

The researchers tested and calibrated the sensors and modules by running simulations of the specific type of disaster or situation they were particularly designed to detect or measure. The following were the methods used for calibration per sensor:

* measuring the heat index of a candle flame at close proximity for the DHT11 Humidity and Temperature Sensor
* measuring the water level desired for triggering a flood alert by submerging the Arduino Water Level Sensor in a cubic milliliter measuring cube
* simulation of intruder passing by for PIR Motion Sensor
* burning of light materials such as paper and fabric for the MQ-2 Gas Sensor
* simulation of ground shaking via manual vibration for SW-420 Vibration Sensor
* verification of sent alert messages for SIM800L GSM Module

Upon successful calibration of sensors and modules, all electronic ware were connected to their respective casings for final testing as a whole instead of as individual pieces.

The researchers lastly selected an appropriate pattern design for the finishing touches of the project prototype. The intention of this action was to allow the project prototype to remain decorative in quintessence yet keep its function as a home disaster detection and alert device.

**Results and Discussion**

The project was initiated with the goal of satisfying three (3) main questions:

1) Was the project prototype able to measure the attributed values on specific disaster simulations?

2) Did the project prototype perform its alarm function spontaneously after detection?

3) Was the project prototype able to utilize SMS and send an alert message after detection on specific disaster simulations to the saved user contact number?

After multiple tests and evaluations, the Disaster Alert Box was found to have satisfied all three questions and it has sufficiently carried out its function as a portable home device for disaster detection interfaced with SMS alert messaging.

**Conclusion and Recommendation**

DAX has the potential to develop into a legitimate patented product to be introduced in the industry responsible for distributing DRR technologies that handles common or frequently occurring disaster problems.

This project could pave the way towards the future of creative home furniture design such that DRR technologies would be integrated into said design while still keeping its basic function and properties as a piece of furniture.

Given that the researchers had to work on a limited budget, certain aspects such as the sensors and design could certainly be further improved on in order to add value to the project and boost its performance.

By having an increased budget, better parts and wares could be purchased and used to provide more accurate, more efficient, and faster results.

Since this project is only in its prototype-innovative stage, DAX is still highly available to changes and further improvements.

**Appendices**

Identify natural hazards in your project area and understand how to reduce their impact. (2019, May 23). Retrieved from [http://­thinkhazard.org/­report/­196-philippines](https://lm.facebook.com/l.php?u=http%3A%2F%2Fthinkhazard.org%2Freport%2F196-philippines%3Ffbclid%3DIwAR25Fm7yYlyqTCz-_zg-310_MRANa-IXGoaVFOVuoXCGh0cvpmtkhkvWps4&h=AT1sTTWEu0k1cBTbclY4t7qcsmtm401JUcqLmr7O-0SSPnHBl-y0HyOk55UijQVv5nUILueGxYs50CBk3I-2ej3Y5eDmdFDELaP90yasgIJAms9vyoeXfenKind55FePzkQOTQ)

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