Chapter II

This chapter includes a review of related literature and studies that the researchers have perused to shed light on the topic study.

FLOOD

According to Collen Calanga et. al. (2020) tropical storms and floods, with 102 and 72 occurrences, respectively, are the most common calamities, according to the Senate Report from 2013. Clearly, one of the largest issues facing the nation is flooding. According to statistics, flood-related incidents account for 31.9% of all-natural disasters that occurred in the Philippines between 1990 and 2014, with a fatality rate of 5.9%. The goal of the project is to develop flood warning systems and carry out various tests to evaluate the effectiveness and efficiency of the flood warning system as non-structural solutions to the nation's flooding concerns. This paper also aims to address the century-old issue of flooding, deal with the lack of a real-time flood warning system, which would lessen the number of fatalities and property losses, and assess the efficiency of the river warning system's design in providing real-time river water level updates. Results indicate that using river water as opposed to tap water improves performance. At an average ambient sound level of 50 to 60 decibels, the gadget is audible at all distances. Thus, when placed in various river systems, the device is effective in emitting sound alarms.

FLOOD ALARM SYSTEMS

In the research of JG Natividad and JM Mendez (2018) Flood-prone locations are frequent in the Philippines. So JG Natividad and JM Mendez (2018) created research on

how to prevent this flooding. The communities close to the Cagayan River are the focus of their study's effort to create a real-time flood monitoring and early warning system for the province of Isabela's northern region. Modern ultrasonic sensing methods are widely used in many engineering and fundamental science branches. Because ultrasound can go through every type of media, including solids, liquids, and gases, it can objectively and non-destructively explore inside objects. Only the water level detection and early warning system (through website and/or SMS) that informs concerned organizations and people of a potential flood occurrence is the subject of this study. This study also includes an inquiry mechanism to make it more interactive. It allows community members to ask about the current water level and status of the desired area or site that has experienced flooding using the SMS keyword. The purpose of the study is to better equip residents with information and preparation for floods. The originality of this work is in how ultrasonic sensors, a GSM module, web monitoring, and an SMS early warning system are used to assist stakeholders in reducing flood-related mortality. Indeed, it is necessary for the community's welfare and safety, making it relevant and significant.

Joy J. Labo et. al. (2016) says that Community-based early warning systems (CBEWS) are person-centered systems that assist communities in acting quickly to lower the risk of property loss, human loss of life, injury, and loss of livelihood. A tool was created to monitor the Salon River's rising water level following significant precipitation. Water levels are monitored by the equipment using computer programs called River Monitor and Water Level Monitor. Different colored LED arrays shine, and a warning siren sounds at various intervals. Automatic emergency lighting illuminates the apparatus during power shortages. The battery-operated device has levels dependent on the data that is currently

available, with low levels denoting awareness, medium levels denoting readiness, and high levels necessitating an immediate response.

The project made by researchers in Bulacan utilizes image processing as a method for flood detection and incorporates various sensors such as the rain gauge, float switch, and flow rate meter sensor to enhance its reliability. These sensors measure crucial parameters like precipitation rate, flood level, and flow rate. The data collected by these sensors is promptly transmitted to an Android application, allowing residents to monitor flood levels in real-time.

Lean Karlo S. Tolentino,; Rochelynne E. Baron et. al. (2022) research shows an evaluation of the system's reliability that is demonstrated through a comparison between flood-level data obtained from the automated system and conventional methods. The small mean squared error (MSE) of 0.125 indicates a high level of accuracy and effectiveness in the system's performance.

This research highlights the need to understand the storm's characteristics for assessing flood severity. The system described involves an Arduino Uno connected to various sensors, including humidity, flow, float, and ultrasonic sensors. These sensors, combined with IoT technology, are used to predict floods, notify authorities, and sound alarms in nearby communities to quickly communicate flood risks. The system utilizes WiFi to transmit data from the sensors. It also provides estimates on response times for assistance and offers residents a warning window to evacuate if necessary according to

R. M. D. Charaan, J. Shobana, P. Krishnamoorthy, B. A. Princy, R. J. Abinaya and K. Murugesan, "Enhancement of IoT based Flood Detection and Prevention using Arduino UNO with WiFi Module," 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2023, pp. 2290-2294, doi: 10.1109/ICACCS57279.2023.10112673.

ULTRASONIC SENSOR

According to Muhammad Izzat Zakaria A. ; Waheb A. Jabba(2021) An ultrasonic sensor finds widespread application in measuring distance or detecting objects. It employs radio waves to ascertain the distance or range between the sensor and the object. The critical factor is the duration it takes for the wave to travel and bounce back to the sensor. This sensor offers the benefit of being able to detect both metallic and non-metallic objects, including water. As a result, certain Flood Monitoring and Warning Systems (FMWSs) incorporate this sensor into their setup.

Mustafa Mousa; Xiangliang Zhang; Christian Claudel(2015) madea paper titled Flash Flood Detection in Urban Cities Using Ultrasonic and Infrared Sensors introduces a novel sensing device that combines ultrasonic range finding and remote temperature sensing to monitor urban flash floods and traffic congestion simultaneously. The device employs advanced techniques like L1-regularized reconstruction and artificial neural networks for precise data processing. Additionally, the study demonstrates the successful implementation of corresponding algorithms on a low-power wireless sensor platform, showcasing its effectiveness in estimating urban water levels with an error margin of less

than 2 cm in a six-month testing period involving four different sensors. This suggests that the preprocessing and machine learning techniques can operate in real time on currently available wireless sensor platforms.

Anand Sujatha et. al;(2018) added that these sensors operate by detecting sound produced when water approaches them. However, a significant drawback is their sensitivity to loud noises such as heavy rain or other loud external sounds. Specifically, when ultrasonic sensors were deployed near dams and in open-air environments, they were suspended several meters above the ground, leading to their failure.

ARDUINO UNO

According to Muhammad Izzat Zakaria a, Waheb A. Jabba(2021) The Arduino Uno, equipped with a GSM module, gathers data from the sensors and subsequently transmits it to the server or gateway. Additionally, the GSM module relays water level updates and issues warnings in the event of high water levels. The server then forwards the updated data to the FloWS Android Application for real-time examination and monitoring via a graphical interface. It's worth noting, however, that the prototype has undergone testing with only a single node, and the functionality of the GSM module is contingent on the coverage provided by the SIM card. Despite having over a minute to transmit the data, the author has not specified the maximum tested distance for this system.

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The project of C. Gobiya 2; V. Gowsalya 2;R. Masi 2;R. M. Priyanka (2019) introduces an autonomous floodgate system designed to automatically open and close gates as needed. It has the capability to sense both drain water and tidal water levels. The system employs pumps to manage excess water and utilizes DC motors to control the movement of dam gates. A Microcontroller, specifically an Arduino UNO, is employed to oversee all water level operations in the dam. Additionally, it utilizes GSM technology to send notifications to the user regarding the dam's water level. The project aims to prevent water wastage and reduce the need for constant manual monitoring of water levels, thus optimizing resource utilization.

WATER LEVEL INDICATOR

According to Muhammad Izzat Zakaria a, Waheb A. Jabba(2021) Water level indicators operate by employing sensor probes, also referred to as liquid level sensors, to signal water levels. These probes are strategically positioned and activated upon detecting the presence of water. The sensor delivers a binary output to the microcontroller unit (MCU). Notably, this type of sensor does not necessitate calibration during the installation process. However, obtaining a precise reading proves to be highly challenging.

GSM MODULE

Dedi Satria et al 2019 J. Phys.: Conf. Ser. 1232 012023 **,** The flood detector system made by these researchers employs an ultrasonic sensor for water level detection, an Arduino Uno microcontroller for data processing, and a SIM900 GSM module for data transmission to the wireless flood alarm system. The alarm system consists of a GSM SIM900 receiver module, an Arduino microcontroller, and an electric alarm. The prototype successfully triggers the alarm when the water level exceeds 5 cm.

According to C. Gobiya 2; V. Gowsalya 2;R. Masi 2;R. M. Priyanka (2019) The Global System for Mobile Communication (GSM) is a widely adopted standard for digital cellular communication. It originated from a standardization group established in 1982 with the goal of creating a unified mobile telephone standard for Europe. This standard aimed to establish specifications for a pan-European mobile cellular radio system operating at 900 MHz. GSM sets forth recommendations rather than strict requirements. It outlines functions and interface requirements in detail but does not specify hardware details. This approach allows designers flexibility while still enabling operators to purchase equipment from various suppliers.

A GSM modem is a type of wireless modem designed to operate on a GSM wireless network. It functions in a manner similar to a dial-up modem. The key distinction lies in how they transmit and receive data: a dial-up modem does so through a fixed telephone line, whereas a wireless modem accomplishes this through radio waves.

SOLAR ENERGY

The article titled ‘A look into power generation, challenges, and a solar-powered future’ emphasizes the immense potential of solar energy as an abundant and sustainable source of power by Muhammad Badar Hayat et.al (2018). It can be converted into electricity directly through photovoltaic (PV) cells or indirectly through concentrated solar power (CSP) technology. Advances have led to PV cells achieving high efficiencies, up to approximately 34.1% in multi-junction cells. CSP technology also holds promise due to its high capacity, efficiency, and energy storage capabilities. Solar energy finds applications in agriculture, vehicle power, and domestic uses like heating and cooking**.**

Solar technology, particularly through multi-junction PV cells, has achieved impressive efficiencies. Concentrated Solar Power (CSP) technologies, like solar power towers, provide a reliable source of electricity with storage capabilities. Beyond electricity generation, solar energy has the potential to meet the energy demands of crucial sectors like agriculture, automotive, food preparation, and water treatment. Projections suggest that by 2032, solar technology could economically compete with conventional energy sources. Additionally, the environmentally friendly nature of solar energy positions it as an ideal energy source for humanity.

Synthesis

The said literatures discuss significant progress in flood monitoring and warning systems, especially in flood-prone areas like the Philippines. Researchers are concentrating on using advanced technologies like ultrasonic sensors, Arduino UNO

microcontrollers, and GSM modules to create flood detection and alert systems in real-time. These innovations aim to give timely information to communities in danger, ultimately reducing the impact of floods on lives and properties.

Furthermore, it acknowledge the potential of solar energy as a sustainable power source. They emphasize its versatility and its ability to bring about positive changes in various industries. Together, these efforts demonstrate a committed pursuit of technological solutions to address the challenges presented by flooding, while also embracing the potential of renewable energy for a more sustainable future.