POLITEKNIK MELAKA

IOT-BASED FLOOD WARNNING SYSTEM TO ENHANCE COMMUNITY SAFETY IN URBAN AREAS

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JABATAN KEJURUTERAAN ELEKTRIK

NOVEMBER 2025

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This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electronic Engineering (Control)

JABATAN KEJURUTERAAN ELEKTRIK

NOVEMBER 2025

CONFIRMATION OF THE PROJECT

The project report titled "IoT-based Flood Warning System to Enhance Community Safety in Urban Areas" has been submitted, reviewed, and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

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"I acknowledge this work is my own work except the excerpts I have already explained to our source"

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DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : DESIGN FINGERS EXERGAME TO IMPROVE FINE MOTOR SKILL FOR AUTISTIC CHILDREN USING ARDUINO

SESSION: 1 2024/2025

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As a project supervisor, on the date:) **MOHD KHAIRUL MUZHAFAR BIN MD NOR**

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ABSTRACT

To improve community safety in urban areas prone to flash floods, this project creates an Internet of Things (IoT)-based Flood Warning System. The system continuously monitors water levels in drainage systems or flood-risk areas in real time by integrating float switch sensors with ESP32 microcontrollers. The system automatically triggers a multi-layered warning mechanism that notifies local residents and remote users when the water level reaches a predetermined threshold. These mechanisms include visual signals via indicator LEDs, audible signals via buzzers, and instant notifications via the Telegram app. This combination of hardware and software ensures fast and efficient warning delivery, allowing users enough time to take preventive actions. Hardware design, circuit integration, sensor calibration, embedded programming, and flood simulation testing are among the key phases of the development process that evaluate the reliability and performance of the system. With a fast response time of less than one second, the device demonstrated excellent accuracy in identifying three different water levels during testing. The reliability of communication between the ESP32 and the Telegram server was confirmed by the continuous and timely delivery of Telegram alerts. The system is suitable for widespread community deployments such as residential and urban drainage networks due to its small size, low power consumption and affordable price components. In summary, this Internet-based Flood Warning System has proven itself to be a reliable, affordable and easy-to-use solution for flood detection and early warning. In flood-prone areas, effective real-time monitoring and rapid response times can reduce the risk of property damage, loss of life and economic disruption. The system may be developed into a complete smart disaster management solution that promotes safer and more resilient communities with additional enhancements such as integration with meteorological data and mobile applications.

ABSTRAK

Untuk meningkatkan keselamatan masyarakat di kawasan bandar yang terdedah kepada banjir kilat, projek ini mewujudkan Sistem Amaran Banjir berasaskan Internet of Things (IoT). Sistem ini sentiasa memantau paras air dalam sistem perparitan atau kawasan berisiko banjir dalam masa nyata dengan menyepadukan penderia suis apungan dengan mikropengawal ESP32. Sistem ini secara automatik mencetuskan mekanisme amaran berbilang lapisan yang memberitahu penduduk setempat dan pengguna jauh apabila paras air mencapai ambang yang telah ditetapkan. Mekanisme ini termasuk isyarat visual melalui LED penunjuk, isyarat boleh didengar melalui buzzer dan pemberitahuan segera melalui aplikasi Telegram. Gabungan perkakasan dan perisian ini memastikan penyampaian amaran yang cepat dan cekap, membolehkan pengguna cukup masa untuk mengambil tindakan pencegahan. Reka bentuk perkakasan, penyepaduan litar, penentukuran sensor, pengaturcaraan terbenam, dan ujian simulasi banjir adalah antara fasa utama proses pembangunan yang menilai kebolehpercayaan dan prestasi sistem. Dengan masa tindak balas pantas kurang daripada satu saat, peranti ini menunjukkan ketepatan yang sangat baik dalam mengenal pasti tiga paras air yang berbeza semasa ujian. Kebolehpercayaan komunikasi antara ESP32 dan pelayan Telegram telah disahkan oleh penghantaran makluman Telegram yang berterusan dan tepat pada masanya. Sistem ini sesuai untuk penempatan komuniti yang meluas seperti rangkaian perparitan kediaman dan bandar kerana saiznya yang kecil, penggunaan kuasa yang rendah dan komponen harga yang berpatutan. Secara ringkasnya, Sistem Amaran Banjir berasaskan Internet ini telah membuktikan dirinya sebagai penyelesaian yang boleh dipercayai, berpatutan dan mudah digunakan untuk pengesanan banjir dan amaran awal. Di kawasan yang terdedah kepada banjir, pemantauan masa nyata yang berkesan dan masa tindak balas yang pantas boleh mengurangkan risiko kerosakan harta benda, kehilangan nyawa dan gangguan ekonomi. Sistem ini mungkin dibangunkan menjadi penyelesaian pengurusan bencana pintar lengkap yang menggalakkan komuniti yang lebih selamat dan berdaya tahan dengan peningkatan tambahan seperti penyepaduan dengan data meteorologi dan aplikasi mudah alih.

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LIST OF ABBREVIATIONS

IoT	Internet of Things
ESP32	Espressif Systems Processor 32 Pin
LED	Light Emitting Diode
PVC	Poly Viny1 Chloride

CHAPTER 1

INTRODUCTION

1.1 Introduction

In urban areas, inadequate or improper drainage systems and the effects of climate change which have increased the intensity of rainfall causing flash floods, cannot be notified in urban areas and can lead to loss of life, Inability to notify community earlier caused severe traffic congestion which can lead to loss of property and life. This IoT-Based Flood Warning System functioning as an early warning device to reduce the impact caused by floods in urban areas and indirectly react as assistance tools to our communities. This system started with monitoring water levels in real time using water level sensors and ESP32 technology equipped with LEDs and buzzers. It will warm users through three stages phases namely Safe, Caution and Danger by sending notifications to mobile phones via IoT system. This would increase the level of preparedness in facing flash floods in urban areas and support disaster management strategies.

1.2 Background Research

IoT-based flood warning systems have emerged as a modern solution in disaster management, especially in urban areas prone to heavy rainfall and water overflow. A study by Chitra et al. (2020) highlights the importance of automatic water level detection system using IoT sensors that can detect rising water levels in real-time. The collected data is sent to a cloud platform, allowing users to receive instant notifications via mobile devices. This study proves that the use of microcontrollers and water sensors in IoT systems can improve the effectiveness of early warnings and help communities take immediate action to reduce the impact of floods. (M. Chitra, pp. Smith,2020).

1.3 Problem Statement

Flash floods in urban areas are increasing due to in effective mobile drainage, increasing volume of rainfall. Current flood management systems are expensive and not friendly user, led to an ineffectiveness system. There is an undeniable need for a real-time monitoring system that can bring attention to cities during emergencies. To overcome this problem, we can use a system based on ESP32 technology and water flood sensors with simple ignition alerts. This will benefit urban residents living in areas that are highly prone to flooding, as well as small scale business owners and commuters. The objective is to minimize property damage and protect people during flash floods.

1.4 Research Objectives

The main objective of this project is to develop a low-cost real-time flood warning system using ESP32 and water level float sensor by providing an immediate alarm using LED indicator, buzzer alarm and can make early notifications to users in urban areas via phone notifications. This system aims to improve community safety and vigilance by delivering real-time alerts to residents. This can also minimize the risk of loss of life and property. In addition, this project supports the United Nations Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities by contributing to disaster risk management and promoting resilience in urban settlements.

More specifically, the main objectives of this research are:

1. To design a real-time flood warning system using ESP32 and water level float sensor to detect rising water levels.
2. To implement warning mechanism using LED indicators, buzzer alarm and mobile notifications via phone notifications for immediate flood warnings.
3. To develop a cost-effective and efficient flood warning solution that can improve the preparedness and resilience of urban communities to flood-related disasters.

1.5 Scope of Research

This research focuses on the development and implementation of IoT-based Flood Warning System to Enhance Community Safety in Urban Areas. The scope of this project:

1. Focuses on the development of a real-time flood warning system especially for urban areas, where flash floods pose a significant risk to residents and property.
2. The emphasis is on integrating ESP32 with a float level sensor to detect rising water levels and trigger immediate warnings via LED indicator lights, alarm buzzer and push notifications to the phone.
3. The main controller uses an ESP32, which serves as the core processing unit to collect sensor data, process flood level conditions and send notifications via the Telegram app.

1.6 Project Significance

This project improves flood preparedness in urban areas by providing real-time alerts through LED indicators, buzzer alarm and push notifications via phone. Therefore, with ESP32 and water float level sensor, residents can take early action to reduce risks to life and property. This system also offers a low cost, efficient solution that can support disaster risk management and is in line with SDG 11: Sustainable Cities and Communities. This system can give benefit to local authorities, emergency response teams and communities to further enhance flood mitigation strategies and urban resilience.

1.7 Chapter Summary

This chapter provides an overview of the project, including its background, objectives, scope and significance. The main objective is to develop a low-cost real-time flood warning system using ESP32 and water float level sensors to improve community safety through early warning. The scope focuses on flood detection in urban areas with notification via LED indicators, buzzer alarms and push notification to phones. The significance risk management and its alignment with SDG 11: Sustainable Cities and Communities. The next chapter will discuss the literature review, covering relevant studies, existing flood warning systems and related technologies used in this project.