

# An IoT-Based Automated Car Lift System with Real-Time Monitoring via Blynk and OLED Display

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## Abstract

This project aims to develop an IoT-based automated car lift system that responds to rising floodwaters, reducing the risk of vehicle damage in low-lying parking areas. The objective is to create a functional prototype capable of real-time flood detection, automatic car elevation, and remote monitoring. The system integrates a water level sensor, ultrasonic sensor, DC motor, OLED display, and LED indicators, all controlled by a WeMos D1 R32 microcontroller. The Blynk mobile application was configured to display flood severity, the distance between the car and the ultrasonic sensor, a manual control button to lower the car, and to send instant alerts when the water level reaches a critical threshold. The prototype was developed and programmed using the Arduino IDE. In testing under simulated flood conditions, the water level sensor successfully identified multiple flood stages and activated the lifting mechanism accordingly. The ultrasonic sensor ensured controlled elevation to avoid over-lifting. Real-time data was displayed on both the OLED screen and Blynk app, with colored LEDs providing quick visual alerts. Results indicate that the system functions reliably and responds promptly to flood conditions. In conclusion, the prototype demonstrates strong potential for real-world application with further improvements in hardware durability, system scalability, and environmental adaptability.

**Key Words:** *IoT, Automation, Flooding, Monitoring, Prototype, Arduino*

## 1.0 Introduction

Flooding is a recurring environmental disaster in Malaysia, especially during the northeast monsoon season. Major cities and residential areas often suffer from flash floods, leading to extensive damage to properties, particularly vehicles. Repairing flood-damaged cars is costly, and many insurance policies offer limited coverage. This problem demands innovative solutions that can act quickly and autonomously.

In response to this need, this project proposes an automated hydraulic car lift system using Arduino-based sensors. The system detects floodwater early and autonomously lifts the vehicle to a safe height, preventing water from reaching critical parts. The prototype offers a low-cost, scalable solution that could be deployed in residential garages, parking lots, or commercial settings.

## 2.0 Literature Review

The integration of Internet of Things (IoT) technologies with automated mechanical systems has become increasingly relevant in addressing environmental and safety-related challenges. Various studies have explored the use of microcontrollers and sensor-based systems to detect and respond to real-time environmental conditions, particularly in flood-prone areas. For example, Rahman et al. (2020) developed a flood detection system using ultrasonic sensors and an Arduino board to monitor water levels in drainage systems. Their system successfully alerted users through a mobile application, demonstrating the feasibility of IoT for real-time environmental monitoring.

Similarly, Kumar and Singh (2019) implemented a smart flood alert system using GSM and IoT platforms, where water level sensors triggered warning messages to residents. However, these systems primarily focused on notifications and did not offer mechanical intervention to protect physical assets. This limitation highlights the need for systems that go beyond alerting and can autonomously respond to environmental threats.

Research on smart parking systems has introduced the use of automated lifting mechanisms, typically for space optimization rather than flood protection. Park and Kim (2018) proposed a

motor-driven vertical parking lift controlled by a microcontroller. While their work improved parking efficiency, it lacked any environmental sensing or remote monitoring components.

With the development of more powerful microcontrollers such as the ESP32, used in the WeMos D1 R32 board, the integration of real-time sensors, motor control, and cloud-based applications like Blynk has become more practical (Zhou et al., 2021). These systems allow for seamless automation and user interaction through smartphones, opening opportunities for responsive and intelligent systems that combine both sensing and actuation.

This project builds upon existing work by integrating flood detection, automated vehicle lifting, and IoT-based remote monitoring into one cohesive system, offering a more comprehensive approach to urban flood mitigation.

### 3.0 Methodology

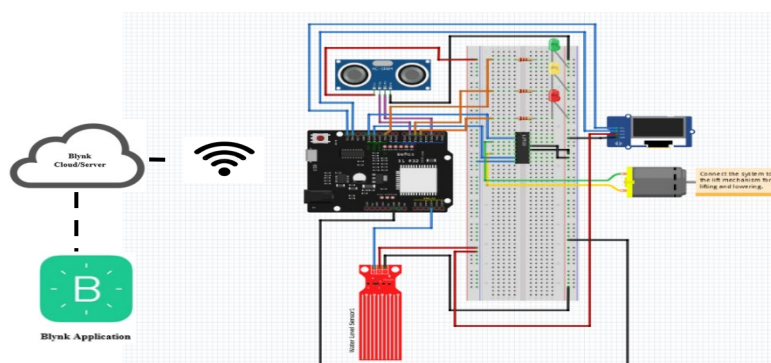
To guide the development of this project, the ADDIE model was used as the main methodology. This model includes five structured phases—Analysis, Design, Development, Implementation, and Evaluation—which helped ensure that the system was well-planned, properly built, and effectively tested. Each stage played a key role in the successful creation of an automated vehicle lift system designed to respond to flood conditions.

#### 3.1 Analysis

In the first phase, the problem was clearly defined: the risk of vehicle damage caused by sudden flooding, especially in low-lying parking areas. Through observations and casual conversations with users, it became obvious that there was a strong need for an automated solution that could help protect vehicles during such events. This phase highlighted the importance of including real-time flood detection and a mechanical response that could work automatically without human intervention.

#### 3.2 Design

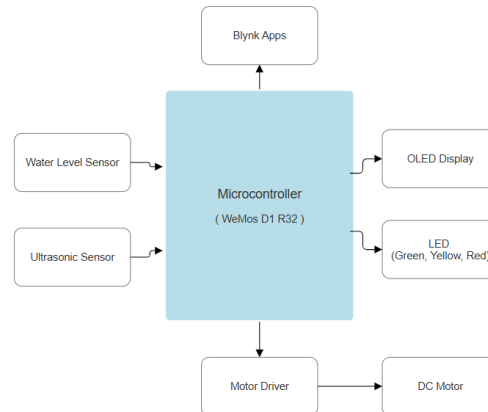
Based on what was learned during the analysis, the system design was carefully planned. It included several important components: a water level sensor to detect flood conditions, an ultrasonic sensor to measure how high the car is lifted, and a DC motor to move the lift. A schematic diagram was developed during this phase to map out the hardware connections between all components, ensuring accurate and efficient integration. To make the system more user-friendly, an OLED screen was added to show real-time sensor readings, LED indicators were used to visually show the flood level (green for safe, yellow for warning, red for danger), and the Blynk app was integrated so users could monitor everything from their phones and get notifications when water levels get too high.



**Figure 1:** Schematic Diagram of IoT-Based Automated Car Lift System with Real-Time Monitoring via Blynk and OLED Display

### 3.3 Development

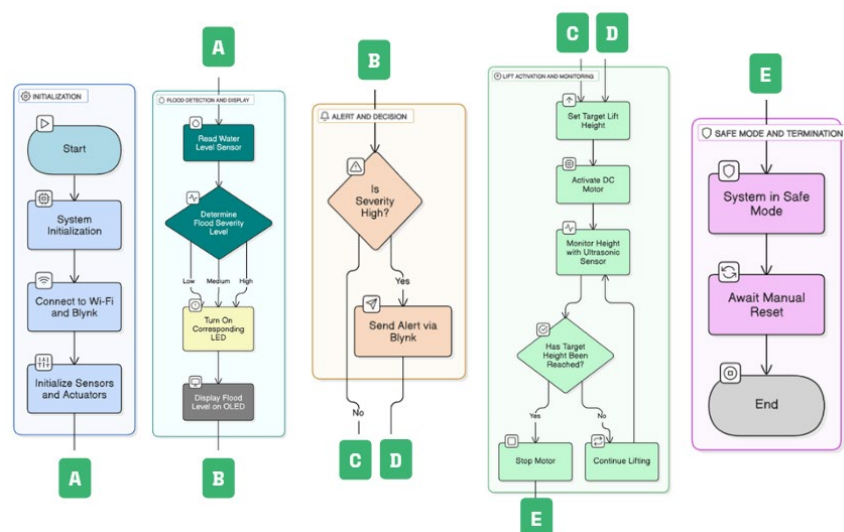
In this phase, the actual building and programming of the prototype took place. The system was assembled using a WeMos D1 R32 microcontroller (based on the ESP32 chip) along with the sensors, motor, OLED display, LED indicators, and an L293D motor driver. The L293D played a crucial role in controlling the DC motor's direction and operation, allowing the lift mechanism to raise or lower the car as needed. Using the Arduino IDE, the system was programmed to automatically lift the car when flood levels crossed a set threshold. At the same time, the Blynk application was set up to show real-time data, LED statuses, and to send push notifications to users when flood risks were detected (above analog value 1900).



**Figure 2:** Block Diagram of IoT-Based Automated Car Lift System with Real-Time Monitoring via Blynk and OLED Display

### 3.4 Implementation

After everything was built and coded, the system was tested in a controlled environment that simulated different flood levels: dry, low, medium, and high. The sensors were tuned to detect these conditions accurately. The system's response—including lifting the car and updating the OLED screen and Blynk app—was closely monitored. Both physical feedback (through the LEDs and screen) and remote updates (through Blynk) were tested to make sure everything worked smoothly.



**Figure 3:** Flowchart of IoT-Based Automated Car Lift System with Real-Time Monitoring via Blynk and OLED Display

### 3.5 Evaluation

Finally, the system's overall performance was evaluated. The main things assessed were how fast and accurately the system responded to changes in water levels, how reliable it was, and how much power it used. The DC motor helped keep power usage efficient, and the Blynk integration ensured users received consistent updates and alerts. Feedback from users showed that having both physical indicators and mobile notifications made the system easy to understand and practical to use in real situations.

### 4.0 Results and Discussion

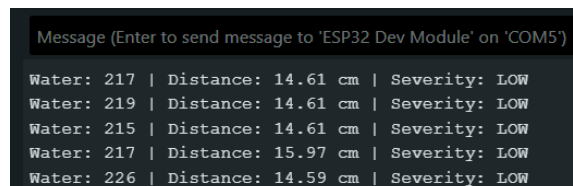
This chapter presents the results of developing and testing the IoT-based automated car lift system with real-time monitoring via Blynk and OLED display. The system integrates a water level sensor, an ultrasonic sensor, and a DC motor controlled by a WeMos board. The performance of the system was evaluated based on its responsiveness, accuracy, and ability to operate the motor based on real-time sensor inputs. Initial testing was conducted on a breadboard to ensure correct wiring and verify the functionality of all components before final assembly. The WeMos microcontroller was programmed using the Arduino IDE to monitor flood levels and control the DC motor, which lifts the vehicle platform in response to rising water.

To detect flood conditions, a water level sensor was installed at the base of the parking area. This sensor produced analog values corresponding to varying water levels. These values were categorized into four flood levels: Dry, Low, Medium, and High. Table 4.1 summarizes the sensor value ranges and their corresponding flood level descriptions. Each category was carefully defined based on repeated sensor testing under controlled water height simulations to ensure consistency and accuracy.

The threshold values allowed the system to trigger specific actions according to the severity of flooding. In the Dry condition, the system remains idle, whereas the Low level activates the initial lifting sequence. As water levels increase to Medium or High stages, the system continues lifting the vehicle to higher positions. These classifications not only inform system behavior but also help provide real-time flood status updates to the user via the Blynk application. The clear distinction between levels ensures the car is protected before reaching dangerous water depths.

**Table 1:** Water Level Sensor Threshold and Description

| Flood Level | Sensor Value Range | Description                         |
|-------------|--------------------|-------------------------------------|
| Dry         | $\leq 42$          | No water detected                   |
| Low         | 43 – 1300          | Initial stage of flooding           |
| Medium      | 1301 – 1900        | Moderate water level, rising flood  |
| High        | 1901 – 2300        | Severe flooding, critical condition |



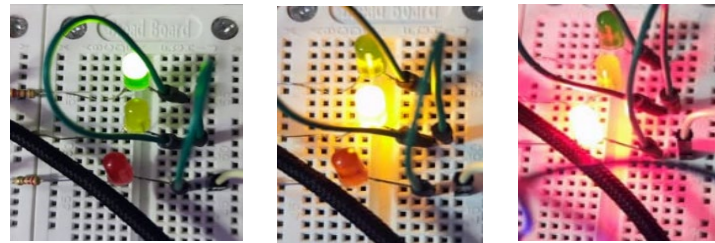
**Figure 4:** Real-Time Water Level and Flood Severity Displayed on Arduino Serial Monitor

To enhance user interaction and ensure effective feedback, several interface components were integrated. LED indicators were used to provide a quick visual reference for flood severity—green for low, yellow for medium, and red for high. These responses, matched with the sensor values and system behavior, are shown in Table 4.2. Each LED color corresponds to a specific flood level detected by the water level sensor, allowing users to assess the situation instantly without relying solely on digital readings.

During normal (dry) conditions, the LED remains off and no motor action is taken. When the water level reaches the Low threshold, the green LED activates, and the car lift mechanism begins operation. If the flood progresses to the Medium stage, the yellow LED turns on, signaling the continuation of the lift. In the High stage, the red LED is triggered, and the system halts the motor at the topmost safe position while also sending a critical alert to the user.

**Table 2:** LED Indicator Response Based on Water Level

| Flood Level | Sensor Value Range | LED Color | System Response                          |
|-------------|--------------------|-----------|------------------------------------------|
| Dry         | $\leq 42$          | Off       | No action taken                          |
| Low         | 43 – 1300          | Green     | Lift starts                              |
| Medium      | 1301 – 1900        | Yellow    | Lift continues                           |
| High        | 1901 – 2300        | Red       | Lift holds position, critical alert sent |



**Figure 5:** LED Indicator Response Based on Water Level

Additionally, an OLED display was included to provide real-time text-based updates of the current water level detected by the system. This ensures that users can view live feedback directly on the hardware unit without relying solely on mobile applications. Table 4.3 summarizes the OLED display messages and corresponding system behavior for each identified flood level.

During the Dry condition, the OLED shows “Flood Severity: DRY”, indicating a safe environment with no immediate action required. As water is detected and the value enters the Low range, the display updates to “Flood Severity: LOW”, informing the user that the system has initiated the lifting process. In the Medium stage, the message changes to “Flood Severity: MEDIUM”, confirming that the car continues to elevate in response to rising water.

When the High threshold is reached, the OLED message updates to “Flood Severity: HIGH”, signaling a severe flood level. At this stage, the system lifts the vehicle to its highest position and prepares to send critical alerts. This real-time display function enhances user awareness and confidence by visually validating that the system is responding appropriately to flood conditions.

**Table 3:** OLED Display Response Based on Water Level

| Flood Level | Sensor Value Range | OLED Message        | Description                       |
|-------------|--------------------|---------------------|-----------------------------------|
| Dry         | $\leq 42$          | WATER LEVEL: Dry    | Safe condition, no action needed  |
| Low         | 43 – 1300          | WATER LEVEL: Low    | Car starts lifting                |
| Medium      | 1301 – 1900        | WATER LEVEL: Medium | Car continues to lift             |
| High        | 1901 – 2300        | WATER LEVEL: High   | Car lifts further, critical level |

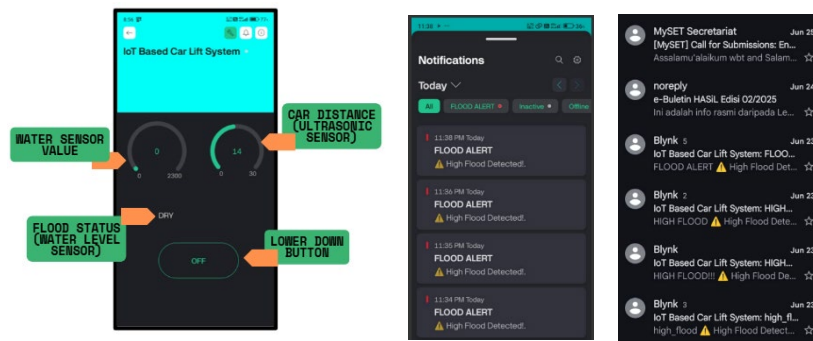
**Figure 6:** OLED Display Showing the Four Flood Severity Levels

In addition to these physical indicators, the Blynk IoT application was configured for remote access and monitoring. Table 4.4 illustrates the integrated responses of the Blynk application based on both the detected flood level (via water sensor) and the real-time car elevation (measured using the ultrasonic sensor). The Blynk interface has been enhanced to provide users with critical system information, including current flood severity, the car's vertical distance from the ultrasonic sensor, and control options such as manual lowering. When the system detects a Dry condition (sensor value  $\leq 42$ ), no action is taken, and the car remains at ground level. In this state, neither distance values nor alerts are displayed in the app. During Low, Medium, and High flood levels, the system activates the DC motor to lift the car accordingly. The Blynk application displays both the flood status and the current lifting height in centimeters. Each flood stage corresponds to a target lifting height, which the system tracks using the ultrasonic sensor ( $\leq 9.00$  cm for Low,  $\leq 6.82$  cm for Medium, and  $\leq 4.55$  cm for High). These values ensure that the car is elevated proportionally to flood severity. When the High level is reached, the Blynk app also sends a critical alert to the user. To avoid repeated or excessive notifications, the alert is set to trigger at one-minute intervals, a setting that is configured directly in the Blynk app and can be adjusted by the user as needed. Additionally, the app provides a manual control button to lower the car once floodwaters recede, and the ultrasonic sensor updates the car's position in real time during the descent.

**Table 4:** Blynk Application Response on Water Level

| Flood Level | Water Sensor Value Range | Gauge Meter (Analog Value) | Flood Status Display (Blynk) | Car Distance Display (Ultrasonic) | Notification Sent | Description                                                                |
|-------------|--------------------------|----------------------------|------------------------------|-----------------------------------|-------------------|----------------------------------------------------------------------------|
| Dry         | $\leq 42$                | 0 – 42                     | Flood Status: Dry            | Not Displayed / Idle              | No                | Normal condition. Car remains in ground position.                          |
| Low         | 43 – 1300                | 43 – 1300                  | Flood Status: Low            | $\leq 9.00$ cm                    | No                | Initial flood. Car lifts to low position. Distance displayed in real time. |
| Medium      | 1301 – 1900              | 1301 – 1900                | Flood Status: Medium         | $\leq 6.82$ cm                    | No                | Moderate flood. Car lifts higher. Distance updated live.                   |
| High        | 1901 – 2300              | 1901 – 2300                | Flood Status: High           | $\leq 4.55$ cm                    | Yes               | Severe flood. Car lifted to topmost position. Critical alert sent.         |

| Flood Level     | Water Sensor Value Range | Gauge Meter (Analog Value) | Flood Status Display (Blynk) | Car Distance Display (Ultrasonic)     | Notification Sent | Description                                                            |
|-----------------|--------------------------|----------------------------|------------------------------|---------------------------------------|-------------------|------------------------------------------------------------------------|
| Manual Lowering | —                        | —                          | Button Activated             | Increasing from $\leq 4.55$ cm upward | No                | Car is manually lowered by user. Live distance updated during descent. |



**Figure 7:** Blynk Application Response and Notifications Alert

The ultrasonic sensor mounted above the vehicle continuously tracks the car's position. When the car reaches a predefined safe height, the system automatically halts the DC motor to avoid over-lifting. Overall, the system integrates real-time environmental sensing with responsive physical and digital feedback, ensuring timely action and enhanced safety during flooding. Table 5 summarizes the integrated system behavior of an IoT-based automated car lift system in response to varying flood levels detected by a water level sensor, and the car's position monitored by an ultrasonic sensor.

**Table 5:** Integrated System Response Based on Water Level and Ultrasonic Distance

| Flood Level | Water Sensor Range | Target Height (Ultrasonic Distance) | LED Color | DC Motor Action                        | System Response                                                         |
|-------------|--------------------|-------------------------------------|-----------|----------------------------------------|-------------------------------------------------------------------------|
| Dry         | $\leq 42$          | —                                   | Off       | Off                                    | No flood. Car stays in position.                                        |
| Low         | 43 – 1300          | $\leq 9.00$ cm                      | Green     | Start lift → Stop at $\leq 9.00$ cm    | Low flood detected. Car lifts to low position.                          |
| Medium      | 1301 – 1900        | $\leq 6.82$ cm                      | Yellow    | Continue lift → Stop at $\leq 6.82$ cm | Moderate flood. Car lifts higher.                                       |
| High        | 1901 – 2300        | $\leq 4.55$ cm                      | Red       | Continue lift → Stop at $\leq 4.55$ cm | Severe flood. Car lifted to topmost safe position. Critical alert sent. |

## 5.0 Conclusion

The development of the IoT-Based Automated Car Lift System successfully demonstrated how modern embedded technology and real-time monitoring can be applied to reduce the risk of vehicle damage caused by sudden floods. By integrating essential components such as a water level sensor, ultrasonic sensor, DC motor, L293D motor driver, OLED display, LED indicators,

and the Blynk IoT platform, the system provided both automated responses and remote-control capabilities in response to rising water levels.

Testing under simulated flood conditions showed that the system responded reliably and promptly. The water level sensor accurately detected different flood stages, triggering the motorized lift accordingly. The ultrasonic sensor monitored the elevation in real time to prevent over-lifting, ensuring safe operation. The OLED display and LED indicators provided local visual feedback, while the Blynk app offered remote access, live data, and timely push notifications—configured to send alerts at user-defined intervals, such as every one minute during high flood conditions.

The structured application of the ADDIE model guided each development phase, and challenges such as sensor calibration and threshold tuning were addressed through iterative testing and refinement.

While the system met its primary objectives, certain limitations were identified. Power consumption, long-term mechanical durability, and weatherproofing are key considerations for real-world deployment. The current prototype is suited for single-car use and may require stronger motor systems and better environmental protection for outdoor or multi-car applications. Additionally, reliance on stable internet connectivity could pose a challenge during severe weather events.

Despite these constraints, the system shows strong potential for scaling to larger parking lots or multi-car configurations by replicating the core design and expanding Blynk dashboards. Future enhancements could include solar power integration, GSM-based alerts for redundancy, and AI-driven flood prediction for proactive response.

Overall, this project illustrates the practical application of IoT in disaster mitigation and highlights the potential of smart technology to enhance public safety and resilience in flood-prone environments.

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