

Intelligent Automated Barrier for Mitigating Internal Flood Damage in Residential Buildings

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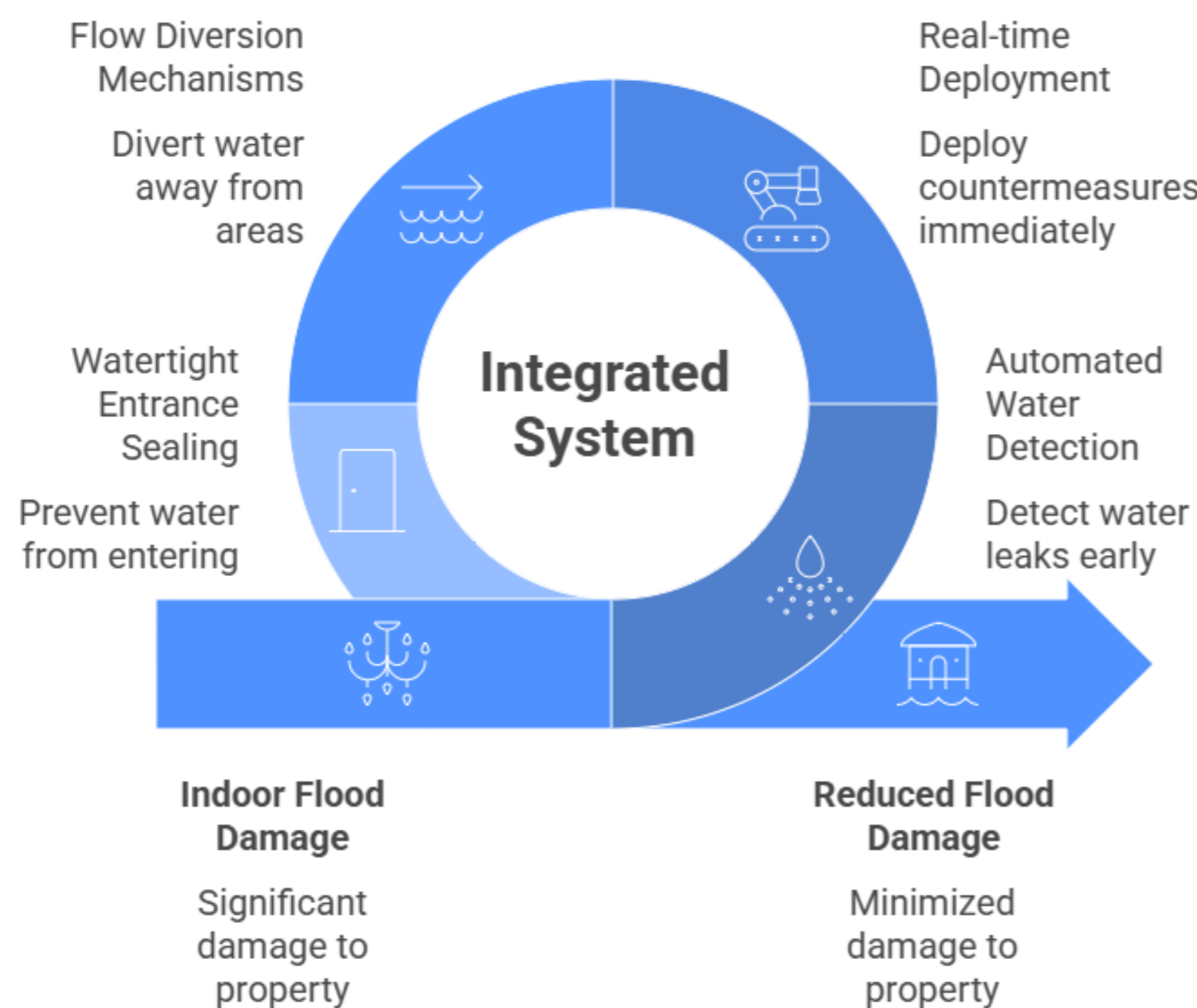
INTRODUCTION & AIM

Flooding events are increasing worldwide due to climate change and extreme rainfall, causing severe economic losses and safety risks in residential areas. Homes located on **sloped streets** are especially vulnerable, as surface water naturally flows downhill and accumulates at door thresholds.

Traditional domestic flood protection solutions often present limitations:

- Require manual installation by the homeowner
- Depend on reaction time during emergencies
- Are ineffective when residents are absent
- Provide only passive protection

To overcome these challenges, this study proposes an **intelligent automated flood barrier** system capable of detecting floodwater in real time and deploying protective components autonomously. The main aim is the following:

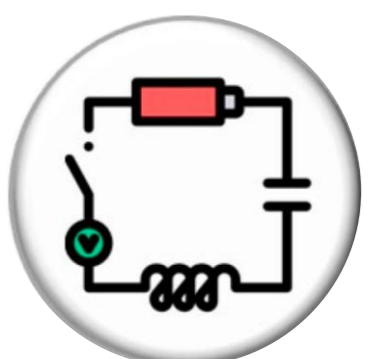


METHOD



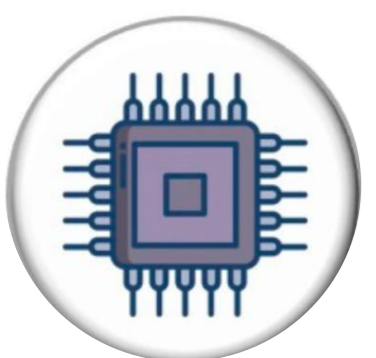
PHASE I – Mechanical Design

Development of the physical barrier structure, including hinged lintels and sealing mechanisms. Optimization of materials and geometry to divert floodwater efficiently away from the entrance.



PHASE II – Electrical Design

Integration of sensors and electronic components for water detection and system activation. Design of power supply and circuitry to ensure reliable performance during flood conditions.



PHASE III – Interaction Programming

Implementation of control logic to interpret sensor data and trigger autonomous deployment. Programming of barrier responses, including activation, timing, and safe retraction sequences.

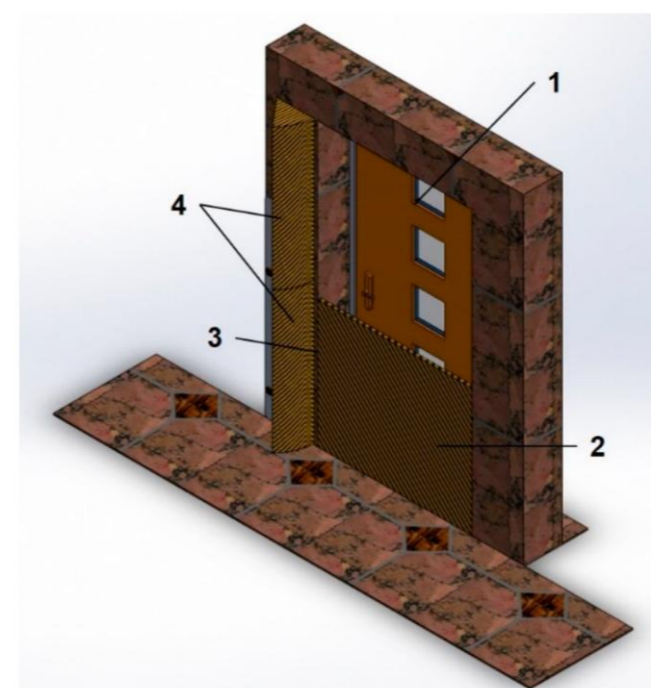


PHASE IV – Automation and Control Design

Development of the complete automated control system using PLC-based architecture. Validation of real-time operation, ensuring fast and safe flood protection without human input.

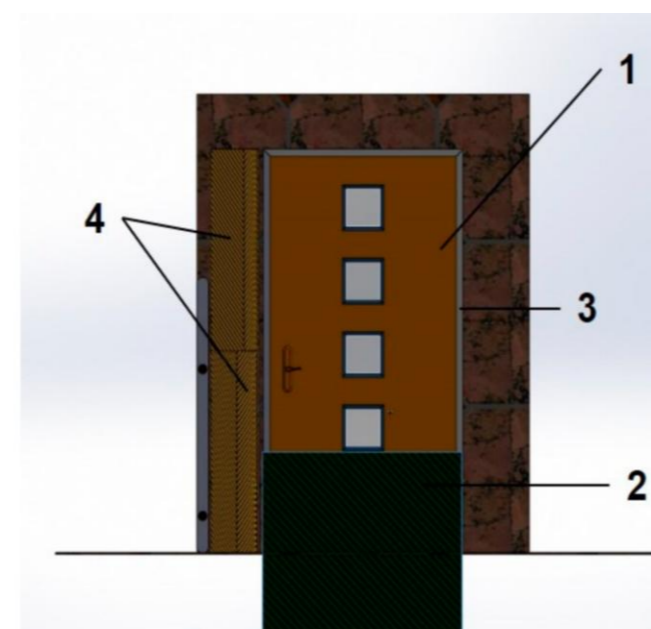
RESULTS & DISCUSSION

Prototype testing and CAD validation confirmed the effectiveness of the proposed automated flood barrier system. The results demonstrate that the combination of diversion lintels and the vertical sealing barrier significantly reduces internal water ingress.



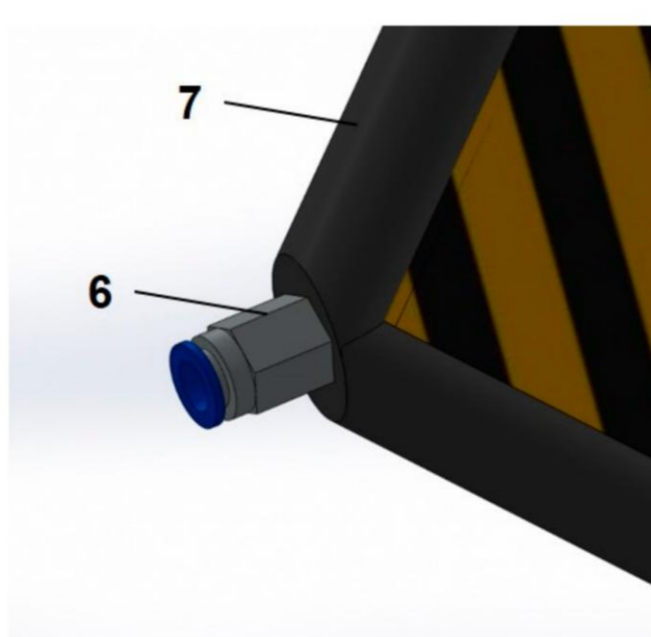
System Installation (3D View)

- Shows the complete barrier system integrated into a standard residential doorway.
- The vertical sealing panel (2) provides the main flood-blocking structure.
- Side lintels (4) are positioned to guide surface water away from the entrance.



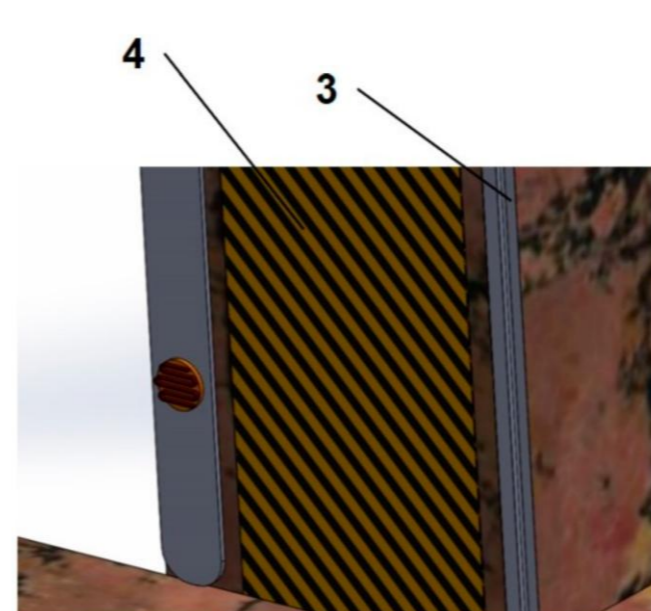
Front Deployment Configuration

Demonstrates the barrier fully deployed at the entrance threshold. The system creates a protective wall that prevents indoor water ingress. Lateral diverting elements reduce direct runoff impact on the doorway.



Inflatable Sealing Mechanism

Highlights the inflatable chamber designed to enhance watertight closure. The sealing adapts to small irregularities and gaps in the doorframe. Improves barrier performance under increasing hydrostatic pressure.



Detail of Sealing Interface

Shows the contact zone between the sealing surface and structural support. Confirms robust alignment of the barrier with the doorway frame. Prevents leakage through lateral edges during floodwater exposure.

CONCLUSION

The intelligent automated flood barrier system demonstrates **strong potential as a proactive solution for residential flood protection**.

- The combination of a vertical sealing barrier and diverting lintels effectively **reduces internal water ingress at building entrances**.
- Automated sensor-based activation **improves response time during sudden flood events** and minimizes the need for human intervention.
- Prototype and CAD validation **confirm the feasibility** of integrating the system into standard doorframes, enhancing household resilience in sloped-street flooding scenarios.

• The Intelligent Automated Barrier presented in this communication is patented in Spain under code ES1261399.