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# Autonomous Snake Detection and Catching System for Household Safety After Calamities

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***Abstract***

*Autonomous Snake Detection and Catching Robot for household Safety after Calamities is a robot to protect house premises from the intrusion of snakes which is a major issue specially after calamities. During floods many incidents of snake encounters and bites were reported in numerous residential areas. According to disaster management experts, the possibility of flood in Kerala still remains and it can cause major impacts in future. Conventional methods for snake catching include tongs, hooks, hand capture and the limitations of these techniques are restrictions in the capability to reach the snake, potential injury and safety concerns. Autonomous Snake Detection and Catching Robot aims to address these limitations while prioritizing the safety of both humans and snakes. The proposal combines the procurement of series number of images and the detection of snake in the captured image with the machine learning concepts implemented through robotic technology, minimizing human intervention and ensuring a safer approach. The system uses the Raspberry Pi platform and YOLO to develop a cost-effective and efficient solution for the safe and autonomous capture of snakes. Real time monitoring is done with the help of cameras. The images obtained from the video captured by the camera module is compared with the trained database and if it matches, the alert system is triggered. Once the snake is detected it is caught by the robot with the help of a robotic arm. Unlike existing solutions the robot does not rely solely on human intervention minimizing human exposure to danger. Ultimately, the snake catching robot contributes to the overall resilience of communities in disaster-prone regions, safeguarding lives.*

**Keywords:** Real-time monitoring, image processing, autonomous robo**t,** rasberry Pi 4

## INTRODUCTION

As calamities strike, households find themselves grappling with multifaceted challenges, and among them, the intrusion of snakes poses a unique threat. Displaced by natural disasters, snakes seek shelter in residential spaces, amplifying the vulnerability of households already facing upheaval. In response to this pressing concern, our project introduces an innovative Autonomous Snake Detection and Catching Robot. Snake handling poses inherent risks to humans, particularly in regions where venomous snakes are prevalent. The Autonomous Snake Detection and Catching Robot is designed to mitigate these risks by providing a robotic solution that autonomously identifies and captures snakes without human involvement. The use of the Raspberry Pi single-board computer and YOLO enables a compact and affordable platform for real-time image processing and decision-making. This project addresses the need for a safer and more efficient method of snake handling in residential areas after calamity like flood.

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Being able to function independently of human assistance in potentially hazardous snake-handling scenarios is one of this robotic system's main advantages. By expediting the process of locating and capturing snakes, this not only improves resident and emergency responder safety but also boosts operational efficiency. Real-time picture analysis by the robot's onboard camera is made possible by the Raspberry Pi's adaptability as a computer platform. By facilitating quick and precise snake identification in a range of environmental circumstances, the YOLO algorithm greatly expands the possibilities of the system. The robot's small size guarantees that it can travel well in difficult terrain, including locations covered in debris from natural disasters like floods. It can even maneuver through small passageways.

The Autonomous Snake Detection and Catching Robot enhances the overall resilience of communities dealing with the aftermath of disasters by offering a safer and more effective method of handling snakes. Because of its self-sufficient ability to recognize and catch snakes, residents may focus on their recovery efforts with more peace of mind and the hazards associated with these interactions are reduced [1].

## PROBLEM DEFINITION

The conventional methods employed in snake catching, often utilizing tools like hooks ortongs, present a range of challenges and drawbacks. One significant issue revolves around the heightened stress inflicted upon the snakes during the capture process. The use of physical restraints and tools can agitate the reptiles, triggering defensive behaviors such as biting. This not only endangers the safety of the handlers but also compromises the well-being of the snakes. Moreover, manual handling in snake catching can lead to injuries for both the snake and the individuals involved in the process. Snakes, when confronted with these invasive methods, may lash out in self-defense, causing harm to themselves or those attempting to capture them [2]. This not only raises ethical concerns but also underscores the need for a more considerate and humane approach. To address these issues, there is a pressing need to explore and adopt alternative snake-catching methods. Non-intrusive traps and relocation strategies, for instance, offer a more humane and ecologically sensitive approach. These methods minimize stress on the snakes, reduce the risk of injuries, and take into account the conservation of these vital species within their natural habitats [3].

## PROPOSED SYSTEM

A proposed system for an autonomous snake detection and catching system for household safety after calamities would involves utilizing a Raspberry Pi-based system equipped with a robotic arm, a trained Python model for image processing, and a camera module to autonomously detect and capture snakes in households post-calamities [4]. The camera module captures images of the environment, which are processed using the trained model to identify snakes. Upon detection, the robotic arm swiftly moves to capture the snake safely. Additionally, a buzzer system provides alerts to occupants, enhancing situational awareness. By integrating these components, our solution offers an efficient and automated approach to mitigate the risks of snake encounters in disaster-affected areas while ensuring human safety (Figure 1).

## SUBSYSTEMS WITHIN THE PROPOSED SYSTEM

### Detection System

The autonomous snake detection and alerting system utilizes a camera module to capture live video feed, integrated with the YOLO framework for real-time object detection, specifically targeting snakes. Upon detection, the system triggers an alert mechanism through various means such as audible alarms to notify users. Additionally, it can implement response actions like capturing images or videos of the snake, sending distress signals, or activating safety measures. A user interface can provide intuitive controls and display detection results. Thorough testing ensures the system's reliability and effectiveness under diverse conditions, emphasizing safety and accuracy in its operation [5].

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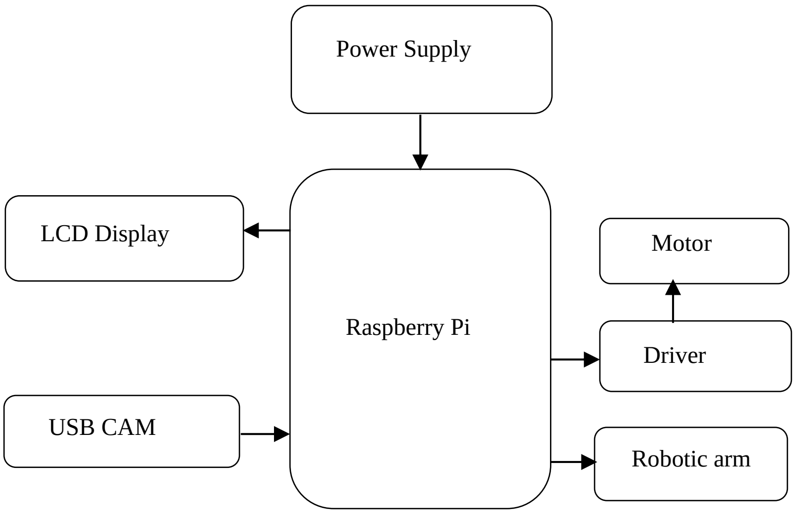


**Figure 1.** Block diagram of the proposed system.

**Catching System**

In addition to the snake detection and alerting capabilities, the system incorporates a robotic arm equipped with a Python-controlled program to facilitate snake catching and removal. Upon successful detection of a snake within the vicinity, the system employs algorithms to precisely locate the position of the snake within the camera frame. This positional data is then fed into the Python program, which orchestrates the movement of the robotic arm to navigate towards the identified snake. The Python program utilizes the positional information to calculate the necessary trajectory and movement parameters for the robotic arm, ensuring accurate and controlled approach towards the target. Advanced motion planning algorithms may be implemented to optimize the path of the robotic arm, taking into account factors such as obstacle avoidance and minimization of disturbance to the surroundings [6].

Once the robotic arm reaches the vicinity of the snake, it executes a carefully coordinated catching maneuver to securely grasp the snake without causing harm. The robotic arm's gripping mechanism may incorporate specialized tools or mechanisms designed to safely handle snakes, such as soft grippers or snake tongs. Throughout the catching process, the Python program continuously monitors the position and behavior of the snake, dynamically adjusting the movement of the robotic arm as needed to ensure successful capture while prioritizing the safety of both the users and the snake [7].

**HARDWARE COMPONENTS**

- *Rasberry Pi 4* - The Raspberry Pi 4 is a versatile and powerful single-board computer (SBC) developed by the Raspberry Pi Foundation.
- *USB-A Camera module* - Using a USB-A camera module with a Raspberry Pi 4 is a straightforward process due to the Pi's support for USB peripherals
- *LCD (16×2)* - Connecting and using a 16x2 LCD with the Raspberry Pi 4 involves interfacing the LCD with the GPIO pins of the Raspberry Pi and using a library to control the display.
- *Sound Buzzer* - Using a sound buzzer with the Raspberry Pi 4 is a simple and effective way to add audio feedback to the projects.
- *Buck Converter* - A buck converter is a DC-DC power converter that steps down voltage while stepping up current [8].
- *12 V 1.3 Ah* - Using a 12V 1.3Ah battery with a Raspberry Pi 4 requires converting the 12V down Battery to 5V, which the Raspberry Pi can use.
- *Servomotor MG995* - The MG995 is a popular, high-torque servomotor often used in robotics and other electronics projects [9].
- *Motor Driver L293D* - The L293D is a popular motor driver IC that allows you to control the direction and speed of two DC motors or one stepper motor.

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- *Ultrasonic sensor* - An ultrasonic sensor is a common device used to measure distance by emitting sound waves and measuring the time it takes for the sound waves to return after hitting an object [10].

## RESULTS

When the autonomous snake detection and catching robot for household safety after calamities is successfully implemented, several beneficial outcomes can be expected. Firstly, the risk of snake encounters and bites in households post-calamities will be significantly reduced, enhancing the safety and well-being of occupants. The robot's ability to autonomously detect and capture snakes will expedite the removal process, minimizing the time between detection and intervention. Additionally, households will no longer need to rely solely on manual methods, thereby reducing the potential risks associated with human intervention in snake removal.

## CONCLUSIONS

In conclusion, the deployment of an autonomous snake detection and catching system emerges as a transformative solution in bolstering household safety amidst the aftermath of calamities. This cutting-edge technology stands poised to revolutionize disaster response strategies, particularly in regions prone to natural disasters where the risk of snake encounters escalates significantly. The paramount significance of this system lies in its potential to save lives and prevent in- juries in the wake of calamities such as floods, earthquakes, or hurricanes. By swiftly and au- tonomously identifying displaced and distressed snakes in residential areas, the system addresses a unique and often overlooked threat, mitigating the potential harm to residents and offering a vital layer of protection during post-disaster scenarios. The expected outcome of this innovative system is a marked improvement in safety through its rapid response capabilities. The integration of artificial intelligence and robotics enables the system to outpace traditional snake-catching methods, reducing the time it takes to detect and capture snakes. This speed is critical in preventing snake-human encounters, minimizing the risk of snake bites, and alleviating panic among residents who are already grappling with the aftermath of a calamity. The autonomy of the system is a key factor contributing to its effectiveness. Operating with- out constant human intervention, it can navigate the chaos and challenges that often characterize post-disaster situations. This autonomy not only enhances the system’s responsiveness but also ensures its reliability when traditional rescue efforts are stretched thin or delayed, ultimately bolstering the overall effectiveness of disaster response initiatives. Furthermore, the autonomous nature of the system aligns seamlessly with broader goals of leveraging technology for disaster resilience and recovery. By emphasizing proactive measures and integrating with existing disaster response plans, the system becomes a pivotal component in safeguarding human lives and well-being after calamities. It represents a forward-looking approach that embraces technological advancements to enhance the overall resilience of communities facing the complex challenges of post-disaster environments.

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