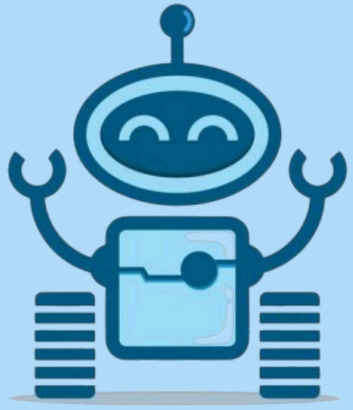
IT21252372 |Madhusankha W.V.S.

BSc (Hons) in Information Technology
Computer Systems & Network Engineering



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Background

- Human security patrols can become fatigued, inconsistent in performance, and cannot blanket the entire area in a large industrial environment. That is why these challenges point toward the need for automation that can ensure consistent and reliable monitoring.

- Robotic patrol systems offer the solution of continuous surveillance, reduction of operational costs, and elimination of human-related inefficiencies. The robots cover difficult terrains and dangerous areas

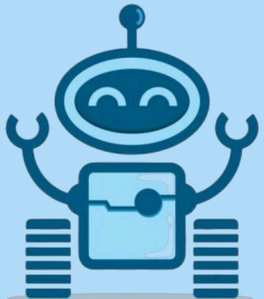
- Data from sensors, like Lidar, cameras, GPS, and proximity sensors, are combined in a way that the robot can navigate with precision, avoiding obstacles for its effective adaptation to changing environments.

Research Question

- How could possibly a multi-sensor fusion technique improve the patrol robot's capacity to follow predetermined paths while dynamically adjusting to changing environmental conditions?

- What algorithms can be built to allow the robot to adjust its patrol route automatically in response to detected barriers or dynamic situations, such as intense light or motion?

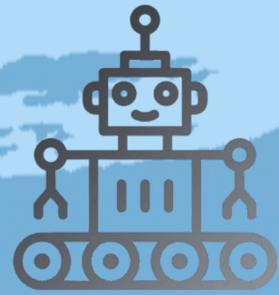
- How can the robot use Lidar and GPS data to accurately map new routes for future investigations while avoiding obstacles?



Research Gap

- ·There has been a lack of extensive research into properly integrating numerous sensors (Lidar, cameras, GPS) for adaptive security patrol robots, limiting developments in navigation and decision-making.

- Current algorithms primarily address predefined routes or basic obstacle avoidance.



Comparison

	Proposed research	Research Paper 1	Research Paper 2	Research Paper 3
Multi-Sensor Fusion (combination of Lidar, cameras, GPS, and proximity sensors)	✓	✓	✗	✓
Dynamic Route Adaptation	✓	✗	✓	✓
Autonomous Mapping and Path Planning	✓	✗	✗	✗
Real-time Environmental Adaptability	✓	✗	✓	✗

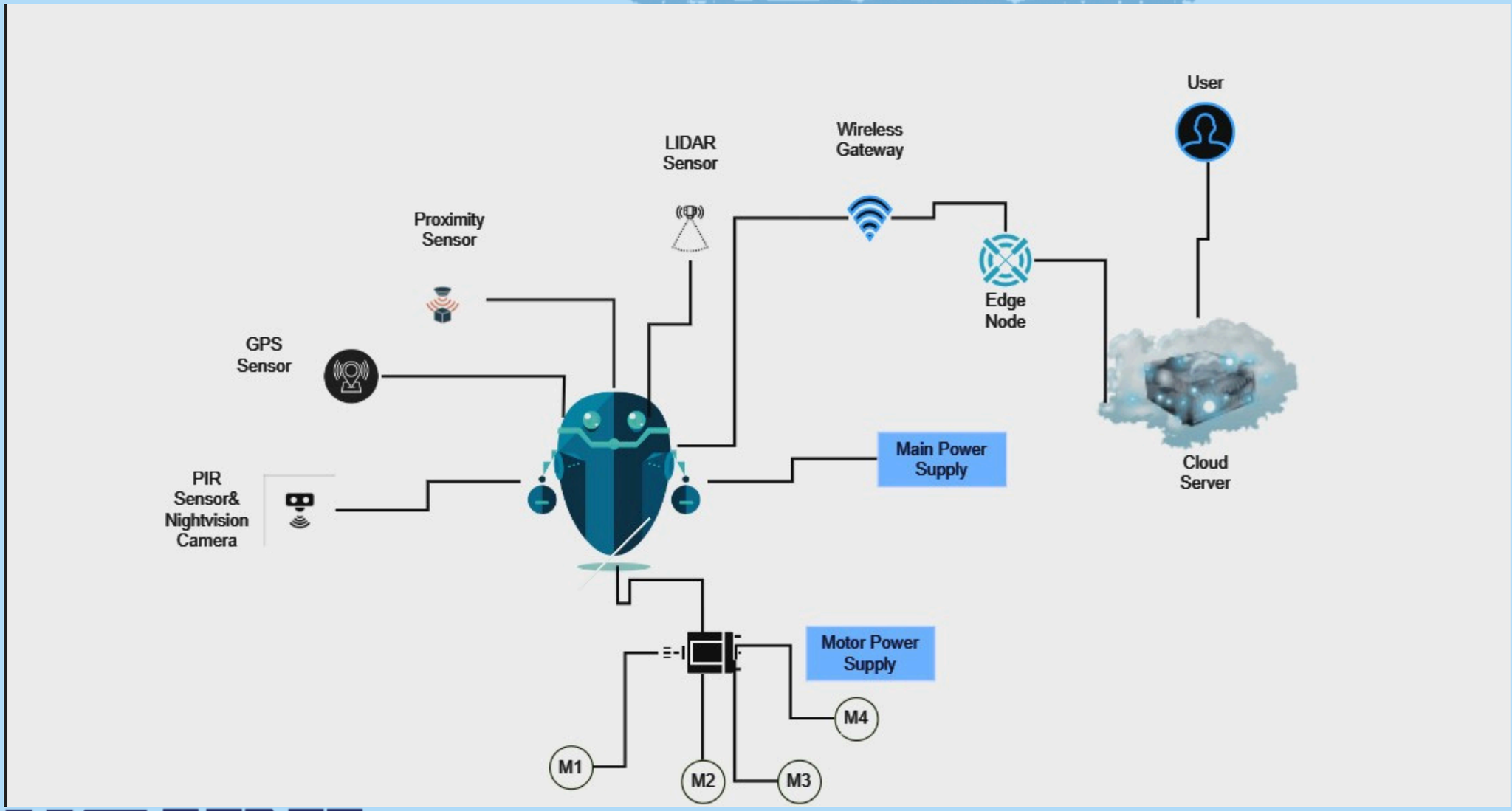
Specific Obective

- Design a robotic system with Lidar, cameras, GPS, and proximity sensors that patrols the warehouses autonomously. The route should automatically be updated according to environmental conditions.

Sub Objective

- Create algorithms that allow the robot to independently follow established patrol routes while adapting to changing warehouse conditions.
- Create algorithms that allow the robot to adjust its patrol route in response to sensor and camera data, addressing conditions such as intense light or motion.
- Integrate proximity sensors and Lidar to ensure the robot can identify obstacles, map new paths, and navigate effectively and safely.

System Diagram



Technologies

MQTT

ARDUINO

ESPRESSIF

HIVEMQ

ublox

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Fuctonal & Non-Functional Requirement

Reference

[1]S. Joy, Richard Lincoln Paulraj, Punith M, Shalini M, Srushti Goudar, and Ruthesh S, “A Raspberry Pi based Smart Security Patrol Robot,” Feb. 2023, doi: https://doi.org/10.1109/iccmc56507.2023.10083908.

[2]“An Autonomous Surveillance Robot with IoT based Rescue System Enhancement ,” ResearchGate, Mar. 03, 2022.https://www.researchgate.net/publication/359134908_An_Autonomous_Surveillance_Robot_with_IoT_based_Rescue_System_Enhancement

[3]J.-H. Jean and J.-L. Wang, “Development of an indoor patrol robot based on ultrasonic and vision data fusion,” Aug. 2013, doi: https://doi.org/10.1109/icma.2013.6618090.

[4]L. Huang, M. Zhou, K. Hao, and E. Hou, “A survey of multi-robot regular and adversarial patrolling,” IEEE/CAA Journal of Automatica Sinica, vol. 6, no. 4, pp. 894–903, Jul. 2019, doi:https://doi.org/10.1109/jas.2019.1911537.

[5]Chun, W. H., & Papanikolopoulos, N. (2016). Robot surveillance and security. In Springer handbooks (pp. 1605–1626). https://doi.org/10.1007/978-3-319-32552-1_61

IT21242472 |Gunawardhana K.A.S.H.

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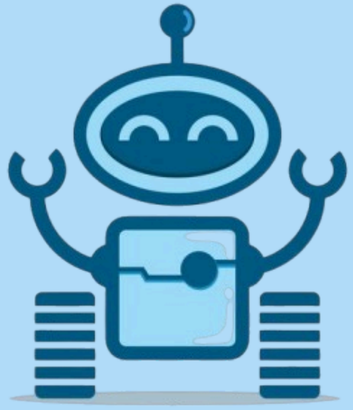

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