**Title: "**Teaming unmanned aerial and unmanned legged robots for automated industrial inspection tasks."

**Indian PI**: Dr. Amit Shukla assistant professor at IIT Mandi, PI in the grand project in the I-Hub Foundation for Cobotics (IHFC), India.
**US PIs**: Dr. Pranav A Bhounsule, Purdue University, University of Illinois at Chicago, US.

This documentation addresses the updates and results we have achieved on multiple points.

1. Procurements and initial testing of the hardware:
   Unmanned Legged Robot: The robot (Unitree Go 1) has been ordered and will arrive by the mid of this month.
   Unmanned Aerial Vehicle: A Pixhawk-based open-source drone has been shipped; initial testing of the drone is complete, and the setting of the onboard computer is still pending. So, for the testing of the developed algorithms, existing drones have been used.
2. Algorithm development and experimental testing: A Wi-Fi-based UDP-IP-based communication protocol for data transfer has been developed and tested. For long-range data streaming, 4G network-based communication is tested for real-time data streaming from the drone.
3. Path planning and motion planning: The drone hovering at a certain height will work as an "eye in the sky". It will detect the robot and generate an obstacle-free path while separating the static obstacle from the environment. For the experimentation, we have used a small, wheeled ground robot and a bottom-facing camera is mounted at the top and will work as a drone camera. The images will be processed in real time, and an optimal path will be generated. This path will go to the ground robot, and it will navigate accordingly on the given path.
   While moving on the path, the camera will continuously localize the robot and send the position coordinates to the ground robot for correction. Currently, an Aruco-marker-based detection strategy is implemented for the detection of the robot and obstacles.
   The current experimental set up and path planning algorithms results are shown below in Fig 1 and Fig 2

Further plans:

1. testing of communication between the legged robot and the aerial robot.
2. Testing the path planning and motion control algorithms with the legged robot
3. development of AI algorithms for real-time detection and tracking of legged robots and generating a segmented map.
4. Development of a local path planner for dynamic obstacle avoidance
5. Real-time mapping of the entire region.

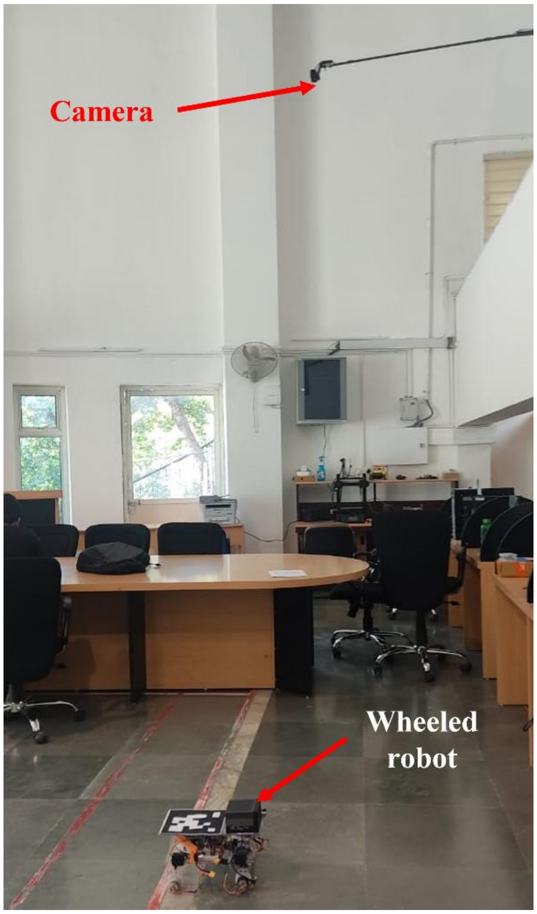


**Fig 1. Current Set Up**

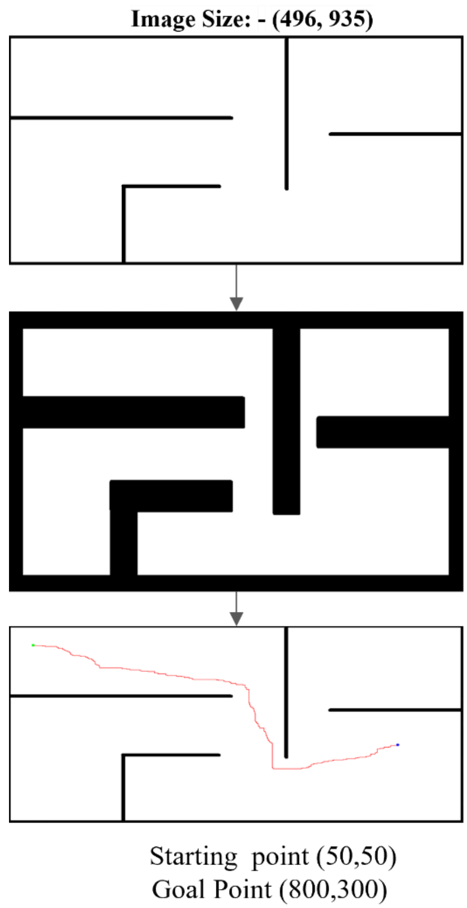


**Fig 2. Path Planning Algorithm**