

ABHYAST A Boeing-IITK Joint

Phase I

Abhyast is an autonomous vehicle being undertaken as a joint activity of IIT Kanpur and Boeing Corporation. The objective is to develop a robot which acts as an aid to the operator in carrying specific task rather than an entity which is in need of continuous attention of operator. Its a 30cm x 30cm x 30cm robot capable of navigating from source to destination using various local and global sensors and is capable of communicating to the user using pre-established GSM networks.

Phase II

Abhyast Phase-II is an extension to Phase-I robot. There were new features added to the previous robot to make navigation better and faster. This project consists of Laser scanner, a new version of Beagle board, IMU and Compass. Apart from the main robot, what made this phase special was swarm robots. These were many small robots, which could localize them self and could communicate to the master robot using X-bee module. The implementation of swarm robotics expanded the choices of navigation fields. The master robot could remotely communicate with swarm, while they can navigate in areas which are difficult for the mother bot to cover.

Phase III

Abhyast has finished its third phase and this time an autonomous robot was developed that would follow a particular direction as given by the user and avoid all obstacles that come in its route and can also jump when instructed to do so. The robot will also send its position wirelessly to a ground station where its trajectory will be plotted through the use of an optical flow sensor. The jumping action was focused in the mechanical section and the electronics consisted of Beagle Board, Laser Scanner, IMU, Arduino, Xbee and optical flow sensor. The programming was done mostly in python that runs on the onboard computer Beagle Board. The detailed plan can be found [HERE](#).

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Phase IV

Abhyast phase fourth finished with the building of a ground bot which is capable autonomously navigating through rough terrain and jumping through obstacles and avoiding them, work was also done in the field of 2D Terrain Mapping using Slam, obstacle avoidance and Path Planning. Swarm logics were developed, applications in

the field of search and rescue, planetary exploration and military and spy applications were proposed.

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Phase V

Abhyast Phase V concluded with building of quadcopter which would provide live feed from scenes and avoid obstacles autonomously. Experimental validation and analysis was produced. A quadcopter was built which could achieve semi-autonomous stable flight, PID controller was implemented, different flight modes i.e Loiter, Altitude Hold were explored. Obstacle avoidance was achieved with the help of Ultrasonic sensors, receivers were overridden when obstacle was detected. Full HD wireless live streaming was achieved using a Logitech camera, object detection involved capturing high quality images and detecting features along with canny edge algorithm, the technique was proposed for the detection of bombs, brief cases and other suspicious objects.

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Phase VI

Phase VI has been started with the problem statement of implementing a robotic system that would autonomously map an unknown environment localizing the suspicious objects and providing this information to a ground station where a manual controller will wirelessly direct a ground vehicle to pick that object(s) and take it to a safe zone, thus avoiding the loss of human lives. The localization and mapping of the area would be done through an autonomous swarm of aerial vehicles. The ground station will utilize this data to identify the suspicious object(s) and plan an optimal path over which the controller will maneuver the ground robot using the live feed obtained from the cameras onboard, to achieve the required task. The phase started successfully and we are making progress on the task.

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For more details: <http://www.iitk.ac.in/dord/boeing/public/>