# AUTONOMOUS SYSTEM FOR TEST SAMPLE COLLECTION FOR MEDICAL LABORATORIES IN HOSPITAL

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**ABSTRACT**

This paper presents experimental investigation on Autonomous System for Test Sample Collection For Medical Diagnosis In Hospitals.The objective of this project is to use a locomotive bot for collection of test samples in diagonisation centers. This is achived by using Arduino UNO as main controller and it is programmed in such a way that it can localize itself based on the environment.

**INTRODUCTION**

As we know that emerging technologies would pay a great way to the most comfortable life as people's wish. The technological development raises the development of whole nation. The new emerging high valued intelligent systems shapes the cultures in various aspects. Various automated devices were developed for automation in industry and home. This expectation motivates us to create an automated product to serve in restaurant for better hospitality. Initially everyone raises a question, is it technically and economically feasible or not. We got motivation and started a work to design and implement a prototype for achieving automation in restaurant. Initially various research work has completed to automate completely in the restaurant using Graphical User Interface (GUI). In that work, they implement an automated product to collect the medical samples remotely without any physical contact in time and those activities gets monitored by a technical person through graphical interface. In our work we are going to implement an automated system for the whole hospital from reach the target place, collecting the sample, delivering the same to laboratory in time and finally ends up with billing. By this product, the physicians can satisfy the consumer by reducing the idle time.

**DESIGN METHODOLOGY**

In this project the bot is designed to collect the test sample of the patients and to deliver to the diagnosing centers along with patient details in order to prevent mix up of data. This bot also comes up with its unique features such as self localization and also be remotely be controlled. This bot is equipped with high torque dc motors and also with high power lion batteries for supporting motors and controller to function for prolonged period of time. The bot also can charge itself when it is in self localized mode.

## NAVIGATION

In our work, the navigation has been achieved by ROS, which facilitates the availability of odometry, SLAM, localization, and path planning. For robot operation, various motion sensors are employed to estimate the position of the robot is referred as odometry. The observed data from the wheel are being displayed as an accepted ROS message using Arduino UNO. However, odometry gets accumulated with errors over time because of the wheel's slip, wear and tear. The information about orientation and heading is collected by the Attitude Heading Reporting System (AHRS) equipped with triple axis gyroscope, accelerometer and magnetometer. A Low cost laser scanner (RP-Lidar) is used to generate a map for the robot. In a typical mobile robot application, the robot is driven in the restaurant to generate a computer map.

As the robot moves, range data from a LiDAR is collected and used by a SLAM algorithm to produce a map. The ability for a robot to locate itself in an environment is a common problem in mobile robots (Fox et al., 1998). Adaptive-Monte Carlo Localization (AMCL) uses a probabilistic localization technique and particle filters to track the pose of the robot against a map loaded from the map server. AMCL (also known as particle filter localization) is an algorithm for robots to localize using a particle filter. Given a map of the environment, the algorithm estimates the position and orientation of a robot as it moves and senses the environment. The algorithm uses a particle filter to represent the distribution of likely states, with each particle representing a possible state, i.e., a hypothesis of where the robot is.

The algorithm typically starts with a uniform random distribution of particles over the configuration space, meaning the robot has no information about where it is and assumes it is equally likely to be at any point in space. Whenever the robot moves, it shifts the particles to predict its new state after the movement. Whenever the robot senses something, the particles are resampled based on recursive Bayesian estimation, i.e., how well the actual sensed data correlate with the predicted state. Ultimately, the particles should converge towards the actual position of the robot.

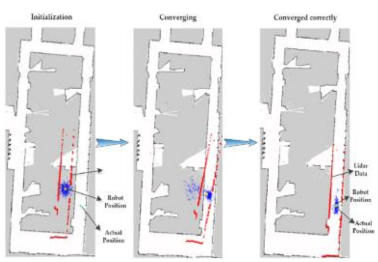


**Fig. 1** ACML process

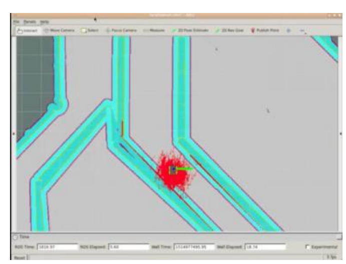

**Fig. 2**Road Map & Navigation

Fig. 2 shows the robot on the cost-map. Dark green and yellow colour indicates the boundary of the environment for the global and local Costmaps respectively, while grey area is the space that the robot can move in. The light green line indicates the path planned which the robot will navigate through.

## EXPERIMENTS AND RESULTS

There are two considerations, related to locate and navigate the robot to deliver food to the right table. The first is the global navigation issue (navigating and locating the waiter robot to the target place) and the second is local navigation (recognizing and docking at the correct position).

To solve the first one, the location of the target table and robot must be known. Two approaches were available with: using Indoor Positioning System (IPS), and using the ROS navigation and localization modules. The objective is to get the robot close to the table to effect docking. With mapping, odometry and motor actuation errors, it is unlikely that the robot will be sufficiently close to the target table. It is also unlikely to be parallel to the table to dock and to deliver the food items.

Two approaches were experimented with it. One uses IR range finders for docking. Two infra-red sensors located on the robot will provide distances to the edge of the table. A program is written to adjust the robot until the two sets of readings are about 0.5 m to the edge of the table. Once the robot is almost parallel, the robot will begin its serving routine. The docking sequence and program is implemented in ROS and the flow chart of this implementation is show in Fig. 3. In the second approach the robot control uses a pixy camera with pan and tilt angles. The camera tracks a colour tag and outputs the pan and tilt angles to the robot controller closer to the table. Results are encouraging but improvements to use pixy to track the flashing LED of the pager is being evaluated.

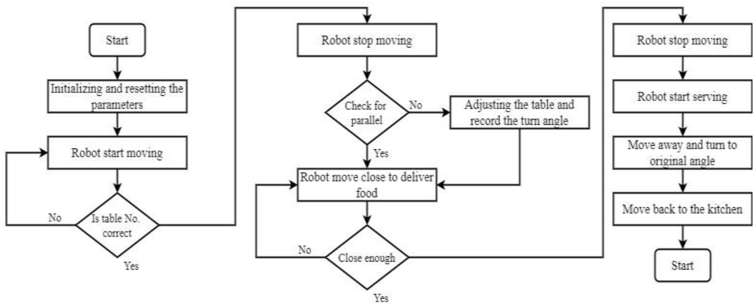


**Fig. 3 -** Flowchart

The development and implementation of the ROS based autonomous system as waiter, improves productivity and helps in employing waiter robots in various restaurants, where interior designs and table arrangements vary so much. The layout plan can be converted to a ROS map efficiently by a single person using an in-house designed movable stable platform carrying the LiDAR and SLAM. The robot is able to localize itself with respect to this map using ROS AMCL process. However, as observed in our tests, robot navigation is affected by real tables and chairs, and it became necessary to use mechanisms to bring the robot closer to the table to serve the food. This will make the use of autonomous robots navigation and localization more robust and suitable for use in different types of food outlets.

## CONCLUSION

By the end of our work, the individual functions – modelling, mapping, navigation, programs developments and the docking, are developed and evaluated in the ROS based robot embedded controller. The prototype pf the robot was tested in terms of localization, navigation, finding target positon and docking. The results are much appreciable and gave us a new hope to proceed further. The work presented here, creates an innovation among budding engineers to develop an autonomous system to deliver drugs. The mobile robotics part of the system is best developed in ROS as there is a community of researchers constantly improving the implementation of planning, navigation and localization algorithms of robots.

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