Project Proposal Form



# Project Name: SPARC Autonomous ROS Platform Robot (SARP-Bot)

## Description of Project

). SPARC's IEEE SoutheastCon Hardware Competition 2019 robot has great hardware for numerous robotics applications in a small form factor. The practice bot will be revamped to support an electronics upgrade to allow more processor intensive computations. The goal of this frame will be to act as a localization and navigation platform utilizing ROS as a means of allowing future and current SPARC members to explore and implement practical navigation algorithms.

## Inspiration

The project was inspired by the IEEE Southeastcon 2019 Hardware Competition. SPARC competed in the competition in past years. This past year’s competition looked interesting and fun but also challenging.

## Past Work on Project (if applicable)

The competition robot utilizes two Raspberry Pi microcomputers to control the robot while using an attached camera to identify the color and shape of the objects on the field. A LIDAR is used to localize the robot on the arena to help avoid the four lights and the wooden box in the middle of the arena. The design of the robot is to move the objects to the appropriate home base by running over the objects, closing a small door on the front of the robot, hold them under the robot and move towards the appropriate home base of the object. The robot unfortunately did not have enough processing power to accomplish the required task. Every aspect of the robot except for navigation operated very well but without proper navigation, it was unable to complete the objective.

## Semester Goals

The new design will utilize an Intel NUC instead of two Raspberry Pi's. This will simplify the design as well as drastically increasing the processing capability of the robot. This will involve a battery replacement to support the higher voltage requirement of the NUC from a 2S to a 6S battery. It will also involve a complete revamping of the software in order to more elegantly and efficiently complete localization and navigational tasks.

## Long Term Goals (if applicable)

## The robot can also easily be fitted with a camera thus allowing it to be used in numerous applications involving navigation and object identification. Two example applications would be developing a solution to accomplish the required tasks for the IEEE Southeastcon 2019 competition of sorting blocks or navigating hallways looking for specific landmarks to emulate self-driving vehicle techniques. Since the robot will not be used for a competition in the near future, constraints such as the size requirement will be ignored but a similar form factor will be kept so that existing parts can be reused.

## E-Day Demonstration Goals (if applicable)

The project could be demonstrated at E-Day in numerous ways. The IEEE 2019 competition field could be setup to demonstrate the robot performing the objectives. A maze-like wooden structure such as the one used for the Turtle bots in E-Day 2019 could be setup to show navigational abilities. Any program that uses both the LIDAR and the camera would make a very cool demonstration.

## Potential Project Leaders

I (Matthew Castleberry) will lead the project as I will be using it as a class project. I might get some assistance from other SPARC members and/or members of the class as needed.

## Technical Skills

* 3D printed
* CAD Design
* Electrical Prototyping
* C++ programming
* Linux software development
* Robot Operating System

## Safety and Testing Considerations

The safety risks are not very high. The biggest concern will be the LiPo batteries as if they are handled improperly can combust. Other SPARC members and I have a decent bit of experience with these types of batteries and understand the precautions necessary. The best ways to protect the batteries is to not short them, not penetrate them, and not leave them plugged into a charger unattended for long periods of time. The only other major concern would be basic mechanism safety. There will be a chain drive with decently powerful motors that all hands and hair should be clear of when the motor battery is activated.

## Funding

Because this project will be a continuation of a previous project, most the parts have already been purchased. The only major things to be purchased will be the Intel NUC, a new LiPo battery, and a voltage regulator. Some small incidentals like screws may be necessary but have not been identified yet. This project should require a budget of $500. This will consist of mostly non-consumable assets to SPARC. The Intel NUC should remain a relevant and fairly actively used SPARC asset for the next 3 to 5 years if properly cared for.