Extendible Desktop Controller for Mobile Robots

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Abstract— Extendable Mobile Robot controller is a desktop application that will allow it to connect to a Mobile Robot and control the same. The application will be designed in such a way that it can be extended based on communication protocol for data exchange. The application will provide basic infrastructure for showing sensor data and providing navigation commands to the robot via GUI. *Keywords— Extendible, Desktop, Controller, Mobile Robots, Plugin.*

I. INTRODUCTION

The robotic is at high pick as the use of robots in various fields is increasing day by day. The humans are replaced by robots as they are smart enough to do work , take decisions, etc. The sub field of robotics i.e. mobile robotics is not enhanced till now. So the main drawback is in spite of having the robot if the controller is not working the robot is of no use ,till now there is no such software is developed that can be configured according to robots specification. Every robot is controlled by humans and has their own controller. As every robot needs their own controller for respective robot, to overcome this problem, Extendable Desktop Mobile Robot Controller is developed.

Developer of the robots can extend the existing controller system according to their needs. The developers can include multiple plugins i.e. DLL's(Dynamic Link Libraries) to implement specific functionality for a particular robot. The system acts as a base, which provides endless possibilities to create a desired controller for a specific robot rather than building a new controller from scratch. The advantages of this system is the cost for purchasing the different types of controllers for different types of robots is reduced.

II. LITERATURE SURVEY

A. *Existing System*

There is no article present on this topic on internet. The topic's referred on internet are "Extensible Hardware Architecture for Mobile Robots" , "Mobile Robot Software Suite" , "control for mobile robots". "Extensible Hardware Architecture for Mobile Robots" this paper is published by Eric Park , Linda Kobayashi, and Susan Y. Lee Intelligent Robotics Group NASA Ames Research Center the abstract of this paper is The Intelligent Robotics Group at NASA Ames Research Center has developed a new mobile robot hardware architecture designed for extensibility and configurability. Currently implemented on the K9 rover, and soon to be integrated onto the K10 series of human-robot collaboration research robots, this architecture allows for rapid changes in instrumentation configuration and provides a high degree of modularity through a synergistic mix of off-the-shelf and custom designed components, allowing eased transplantation into a wide variety of mobile robot platforms. A component level overview of this architecture is presented along with a description of the changes required for implementation on K10, followed by plans for future work. The 2nd paper is Control for Mobile Robots by Christopher

Batten Maslab IAP Robotics Course January 7, 2005 this paper is having the detailed information to robot making , handling, controlling. The 3rd paper is Mobile Robot Software Suite which guides how software for mobile robots are developed.

B. *Major issues associated with existing system*

1) Now a day we require different types of Mobile Robots at different locations for different tasks, and this robots must be handled by humans, But problem is that for different robot we use different controller, for that complexity and cost for buying that controllers is increased.

2) No such system is currently available in the market. The systems which are available are only related to the hardware part.

III. PROPOSED SYSTEM

System developed is the desktop application which has a GUI consists of various fields for controlling and showing the sensors reading of the robots.

Communication :

The drop down has various port number's such as : Com3, Com4, com5, com6

Based on the connection the desired port is to be selected for communication between application and the robot.

Controls :

The control field has four options for controlling the robot

1. Forward : With this option the robot will move in the forward direction.
2. Backward : With this option the robot will move in the backward direction.
3. Left : With this option the robot will turn to left direction.
4. Right : With this option the robot will turn to right direction.

Sensor Reading :

Sensor's reading are displayed

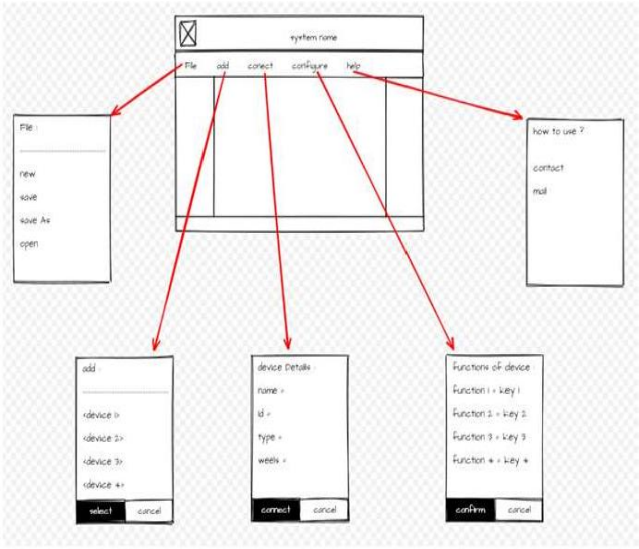
The three essential fields such as communication, controls, sensors reading will be displayed. If the robot is having extra functionality, then plugin of that functionality should be added in the plugin folder of the application. If the plugin is added successfully then that field will be displayed in the GUI.

Metadata:

The system developers have defined a specific metadata

.The plugin developers will fetch the metadata and according to that metadata they have to create suitable plugins. The metadata will be the minimum requirements for the plugin. If a plugin satisfies its properties with the metadata it will be declared as a valid plugin and can be imported in the application. Multiple plugins can be created for different tasks by keeping the metadata of the system in mind.

Prototype of GUI:



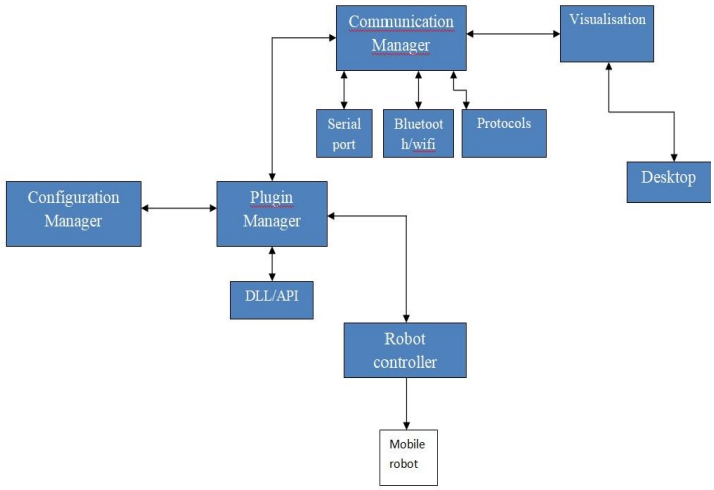
Explanation

- Software Provider will provide the metadata for creating the plugin.

  All the functions that are mandatory must be presents in the plugin.

IV. SYSTEM DESIGN

A. Block diagram for the system:



A. Block diagram for the system:

V. SYSTEM IMPLEMENTATION

A. Software Development Model Used:

The software Plugin-Manager will scan the plugin folder for discovering all plugins.

- All the valid plugins will be added in the list by the Plugin-Manager.
- From the valid plugin list plugin-Manager will load the plugins
- In Loading process connection will be established and based on the plugins the GUI will be displayed.
- Now the software is ready for controlling the robot.

Spiral Model: Spiral Model is a combination of a waterfall model and iterative model. Each phase in spiral model begins with a design goal and ends with the client reviewing the progress. The development team in Spiral-SDLC model starts with a small set of requirement and goes through each development phase for those set of requirements. The software engineering team adds functionality for the additional requirement in every-increasing spirals until the application is ready for the production phase.

B. Algorithm:

- Software Provider will provide the metadata for creating the plugin.
- All the functions that are mandatory must be presents in the plugin.
- The software Plugin-Manager will scan the plugin folder for discovering all plugins.
- All the valid plugins will be added in the list by the Plugin-Manager.
- From the valid plugin list plugin-Manager will load the plugins.
- In Loading process connection will be established and based on the plugins the GUI will be displayed.
- Now the software is ready for controlling the robot.

C. Plugin:

Plugin or DLL(i.e dynamic link libraries) are the elements of the controller which wil be defined by the developer. The developer will create any kind of plugin for different applications and work.We can say that the plugins are the main arms of the controller.It can decide the way of communication,how a particular robot will perform action according to the code of the plugin etc.

Flow :

The working is divided into two parts :

- Plugin creation :

  Plugin creator will use the interface to create the plugin,

  The functions present in the interface are

  i. GetValue;

  ii. Runplugin;

  iii. Destroyplugin.

- Validating the plugin and showing the result:

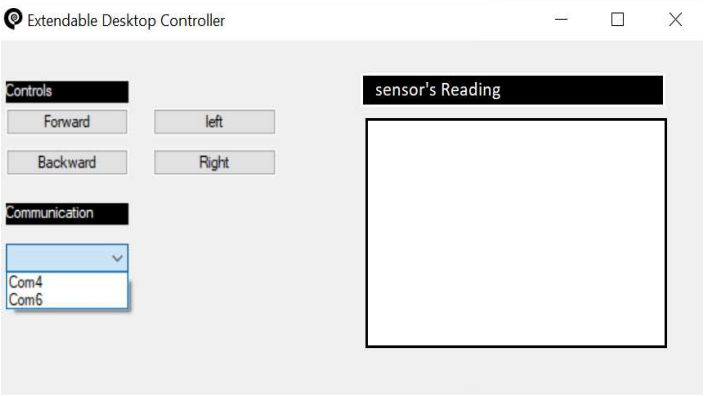
The plugin created by the plugin creator will be validated. In validation process the three function's from the interface are checked if they are present or not. If they are present then that plugin is valid else the plugin is not valid.

If the plugin is valid then the interface object pointer will be returned.

```
-----------------------
Plugin Name : plugin1
Plugin author : author name
Plugin Copyright : copyright of plugin
Plugin Description : descreption of plugin
Plugin Description : no data
run plugin iteration 0
run plugin iteration 1
run plugin iteration 2
```

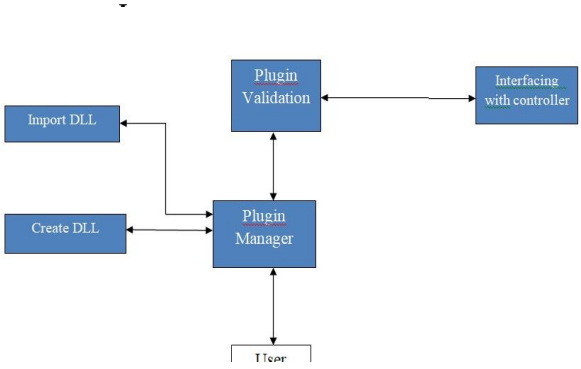
E. Making of GUI:

The GUI of the controller is developed using the C language. The library used for creating the GUI is PCF library developed by Phi education. A basic controller has been created showing some buttons and the dropdown menu.



D. Plugin Manager:

This part of the application will handle all the plugin operations. Like loading plugins, validating plugins, etc. The plugin manager will add the components to the console according to the needs of developer.



CONCLUSION

In this paper we proposed a system for Extendible desktop controller for mobile robots. A prototype using "C" language was made to check the working of the system. The software will reduce the complex task of building a controller from scratch. The system will be easy to use, and easily modifiable. Through this software the cost of the controller can be reduced and the software can be configured according to robots specification. In future update this software should able to handle any type of robot of any specification.

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