Design architecture of Intelligent Robot Systems

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Abstract — With rapidly growing field of robotics technology, it can be observed that robots are designed to perform different tasks in the field of rescue operations. In addition, robots are also capable of communicating with each other. But the concern is the secured long distance data communication and navigation with minimum cost in construction. With these issues in hand, Intelligent Robots can be designed in such a way that they not only will take part in navigations and rescue operations but also enable long distance communication with each other. This paper presents a concept of placing the robots in different places, and how the robots will perform pre-specified tasks and will send the result to other robots via a centralized remote server.

Index Terms — 3G communication, architecture of robot, centralized server, electronic sensors, long distance communication, multiple robot communication, navigation, rescue, robotics.

1 Introduction

Gathering correct information from the environment, such as temperature, atmospheric pressure, humidity manually is one of the most important issues in the field of navigation. Such tasks impose several challenges. Human data collectors have to organize field visit, install sensors and gather information. It is a tedious job and increasing use of latest technology enquires frequent schedule of such visits. It not only less efficient but might result in severe life threatening accidents. Such limitations and problems can be addressed by the use of intelligent robots, which can communicate with each other, transfer data in high speed.

Things to be considered in designing such robots involve recognizing path to be followed and creating an effective communication channel between the robots. Intelligent robots are pre-programmed robots. As soon as these robots start to move, the GPS module equipped with this robot helps to track the location where it is and where it has to be. Similarly each of the robots is equipped with centralized unit that integrates appropriate sensors like temperature sensor, humidity sensor, pressure sensors and obstacle sensors. With the help of electronics sensor and processing unit, the data can be measured easily. The location information and the measured data from the centralized unit can be sent to the server automatically via the Internet. Once the data is stored in the server, the information can be retrieved from anywhere in the world.

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2 Communication

Another issue with this project is creating a proper communication system. The communication system can be divided into two components; Robot-Robot Communication between the robots located at the same location; and Robot-Server Communication for robots to communicate with each other through a server when they are placed at different locations. Let's assume that more than one Robot is navigating within the range of 50 meters. [1] In such condition using a small wireless module such as (XBee, ZigBee or Bluetooth) will be used. This will not only reduce the cost of internet bandwidth but also reduce the complexity involved with implementation of data transmission and receiving modules. Another communication will be established between a server and the robots that are located at disparate locations. The robots will have access to the server via internet (using 3G module) and will be able to store/retrieve data to/from the server and HSPA cellular networks. This module will work as standard 3G MODEM and will able to communicate directly to servers. Using the module, data can be uploaded and downloaded to/from the server directly.

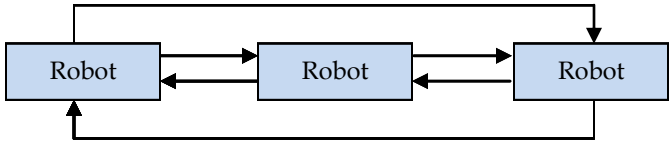

Fig: Robot-Robot Communication within same location

Fig: Robot-Server Communication within different locations

International Journal of Scientific & Engineering Research Volume 5, Issue 5, May-2014
ISSN 2229-5518

3 Architecture

The system architecture of the Intelligent Robot is divided into two parts; Robot Construction and Server Construction. The robot consists of obstacle sensor, GPS module, 3G module and microcontroller unit. The microcontroller that will be used is Arduino UNO. Microcontroller will be used as a processing unit. Simple GPS module will be used in order to track the latitude and longitude of the area at where the robot is lying. Obstacle sensor will be used in order to check and avoid the obstacle. Ultrasonic range finder module will be used as the obstacle sensor. The ultrasonic rangefinder sensor is capable of transmitting and receiving ultrasonic sound. The ultrasonic sound, which when strikes to the object, reflects the sound and is received by the receiver module of the sensor. By calculating the time between the transmission and receiving of ultrasonic sound, we will be able to measure the distance between a robot and the obstacles. For 3G module, 3G shield for Arduino will be used which enables the connectivity to high speed WCDMA.

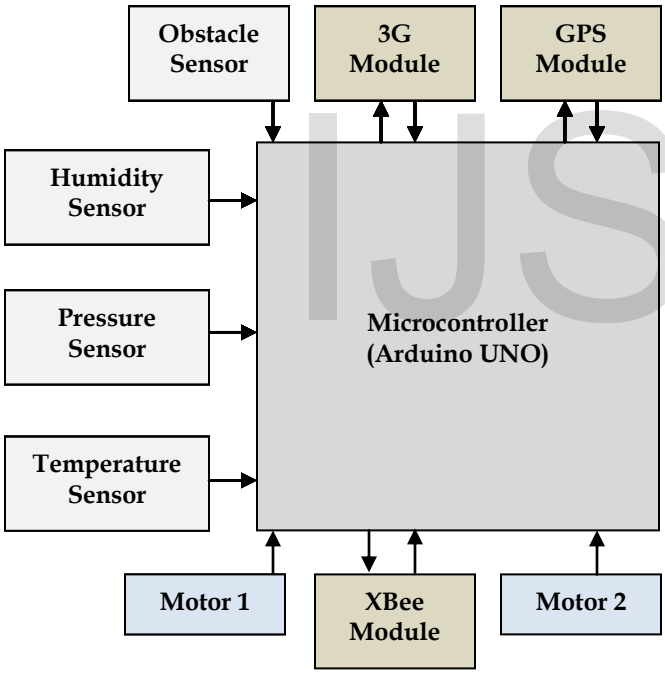

Fig: Construction of Single Robot

4 Key Features

The key features of Intelligent Robot systems include:

- ✓ Robots will be equipped with two wireless transceivers, one for the nearby robots and other for the robots that are located at different geographical locations.
- ✓ The robot-server communication will be easy due to the presence of 3G module.
- ✓ Robots equipped with GPS module, recognize the location of Robot.
- ✓ Different electronics sensors will be equipped with robots to measure different environmental parameters.

5 Conclusion

In this paper, a concept of designing robots that can communicate with each other from different locations is presented. One of the major objectives of this project is to provide design architecture of a system in which robots can communicate with each other with each using a centralized server. With the use of available internet technology, this enables remote controlling of these robots. At present, wireless communication and a robot are already implemented. Integrating wireless communication to a centralized database and creating communication channel between two robots are the important tasks that will be accomplished in the future.

References

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