Control System of Robotic Car Based on Internet of Things

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***Abstract*- Using Cloud generation we will able to retrieve information anywhere. By connecting the entirety to internet gave extra accessibility of data from one type system to every other sort of machine. This paper proposes a multiple motion controlling mechanism of a robotic car the use of Raspberry Pi which matches as master and Arduino UNO which matches because of the slave. Each device is uniquely identifiable by way of the controlling software which is the central concept of IoT. Client manages the activities of the car from far away or distant places over the internet with the aid of voice commands and Universal Windows Application and additionally capable of getting data and feedback. The major contribution of this paper is that it leverages the efficiency of robot's motion controlling system due to the fact the robotic automobile can acquire direct instructions at a time from multiple assets which make the maneuvering system efficient. Both device and client do now not want to be online at the identical time. Commands and records are stored in cloud provider which gives us them while the tool is equipped to get hold of. A GPS machine is incorporated therefore users can trace the car. The device has ultrasonic distance sensor for avoiding limitations coming in between its direction.**

***Index Terms*- Cloud Computing; Internet of Things (IoT); Robots, Raspberry Pi, Arduino, Ultrasonic distance sensor, GPS, motion control**

I. INTRODUCTION

Robotics is one of now fast growing field. Using robots we can reduce the work flow process and also the efficient of manufacturing process could be increase. Artificial intelligence enables us to make robots to act smart for any given situation. The programming of artificial intelligence is too difficult. Also the robot needs to analyse and store more data in the learning process. So, the memory capacity of robot should be greater than any other programming system (because of implementing learning function).

The Internet of things and Cloud are two comparative challenging technologies are been merged together to change not only current and future of the Internet working services. As Internet of Things has limited capabilities of processing power and storage also consequential issues such as performance, security, reliability, privacy, integration of Internet of Things with Cloud is more beneficial for undergoing unlimited capabilities like Storage, and Processing power. Cloud can even benefit from the Internet of things that it can extend its limits with real world things in more dynamic and distributed manner, and deliver massive number of services in real time.[1] Cloud application has realized the business process of industry application, which can be used as a part of the cloud platform, and can also integrate third-party industry applications, such as traffic logistics, health monitoring and agriculture monitoring.[2]

Fig. 1 refers to connecting robotic system into Internet we can access that robotic system anywhere (i.e. we can gave command to the robot anywhere). The development of mobile robots was driven by the desire to automate transportation in production processes and autonomous transport systems. The former lead to driver-less transport systems used on factory floors to move objects to different points in the production process in the late seventies.

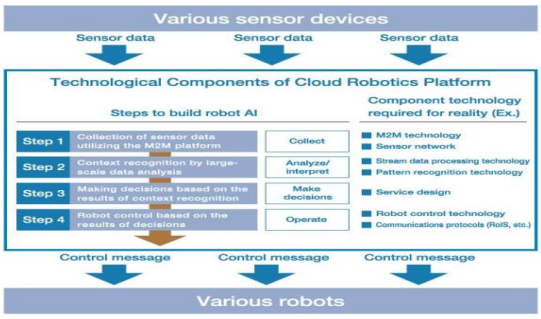

Fig. 1. Components of Cloud Robotics Platform

New forms of mobile robots have been constructed lately like inspected robots with many legs modeled after examples nature gave us or autonomous robots for underwater usage. This method is a kind of development of our proposed method previously [3,4].

Programming the robot also considered as a general concept. So, programming the sensors and other parts (like microprocessor, some chip sets etc.)are also including in this concept. For example, to make a robot which can take a thing. The sensors need to make the robot and programming the dimension of that thing has been taken general concepts to make a robot. In [4] The Internet of Things (IoT) paradigm is based on intelligent and self-configuring nodes (things) interconnected in a dynamic and global network infrastructure. It represents one of the most disruptive technologies, enabling ubiquitous and pervasive computing scenarios. IoT is generally characterized by real world and small things with limited storage and processing capacity, and consequential issues regarding reliability, performance, security, and privacy. On the other hand, Cloud computing has virtually unlimited capabilities in terms of storage and processing power, is a much more mature technology, and has most of the IoT issues at least partially solved. Thus, a novel IT paradigm in which Cloud and IoT are two complementary technologies merged together is expected to disrupt both current and future Internet.

II. LITERATURE SURVEY

Here Raspberry Pi is not just a sensor no debut a controller [1]. Yet the controlling mechanism only includes data collection and updating and works only in indoor environment. Another device controlling mechanism of Raspberry Pi is described in a Raspberry Pi based home automation system through E-mail [2]. The contribution of this paper is, Raspberry Pi can read out the commands of users through E-mail and the devices to be controlled are interfaced with Raspberry Pi using relay driver [2]. However clients can only control the switching state of the appliances, no other controlling system is included.

Jaroslav Sobota et al. [3], proposes extremely inexpensive and flexible control platform using Raspberry Pi and Arduino running the REX control system which is an open system for embedded control [3]. On the other hand, REX platform is not standard enough and unable to control a large number of devices at a time.

Another real- time monitoring system has been implemented in developing a fire alarm system using Raspberry Pi and Arduino [4]. In this paper it is described how Raspberry Pi controls the situation based on sensors. However it has no incorporated any user controlled interaction and is only a sensor based module. Anita Sabo et al. described a controlling mechanism of robotic arm using Raspberry Pi through the internet in a research paper [12]. In spite of its advantages, it has some limitations. It only incorporates the controlling mechanism through web service and the client is unable to detect its location. Further, there is no feedback system and so the client has no way to be sure of effective execution of command, which is a must-have feature in any system connected to the internet.

The solution for the problems from the previous researches as stated above is to develop a multiple controlling system that allows clients to control robots from distant places through voice commands and client application over the internet. Wireless connection is considered here. In this paper, the motion control system of robotic car is considered. Initially the commands include: move forward, move backward, turn left, turn right, rotate left, rotate right, activate obstacle detection, and deactivate obstacle detection.

III. PROPOSED FRAMEWORK

In this section the system workflow described in details. The working procedure is divided into seven major parts and they are as follows:

A. Sending command

There are two modes of sending command to the car: voice command or manual clicking of buttons visible in the user interface. The possible words or commands that might be spoken by users are listed in a XML grammar file. Users can also control the car directly from the interface of UWP application and send any command same as before.

B. Checks for command validation

In order to recognize speech, a Speech Recognizer object is created. A XML grammar file is fed to that object which uses this file to decode speech from signal after proper processing. On successful decoding the dedicated event handlers take care of the rest of the task. But on unsuccessful decoding the client is requested to generate any command from the set of valid commands. This request is in actual a message displayed on the user interface of the application.

C. Stores commands in a cloud service

The UWP application stores command in a Queue of the cloud service hosted by Azure IoT hub. Queue provides a well-defined and flexible service to this system. As both car information and commands were needed to be transferred at the desired places or devices and at the same time, so two queues were used- one for data and another for command. The Raspberry Pi in the car listens to the Command Queue and its ends data to the Data Queue. On the other hand the UWP application in the controller end listens to the Data Queue and it sends command to the Command Queue. As both the end system-components need not be connected to the Azure IoT hub at the same time so it provides the system more guaranteed performance.

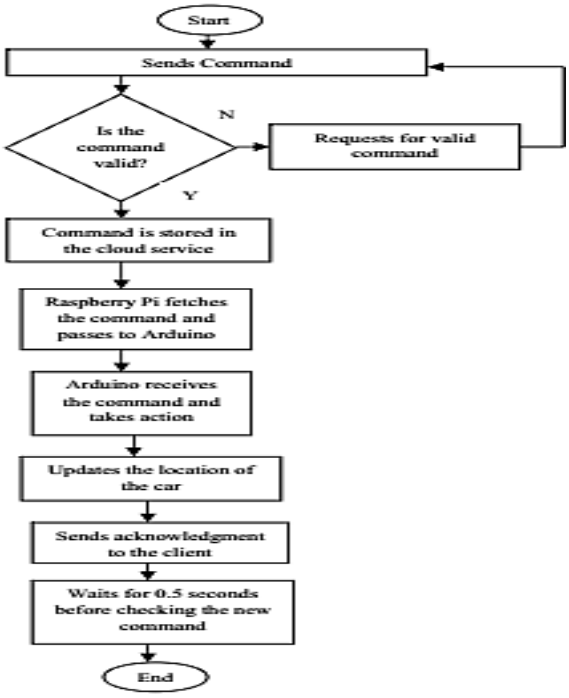

Fig. 2 Workflow of the Proposed System

D. Raspberry Pi collects the command and passes to the Arduino

Raspberry Pi checks for commands and fetches them from the command queue of cloud service in every 0.5 seconds. Raspberry Pi and Arduino communicates with each other through the communication protocol called I2C (Inter Integrated Circuit). They have different unique addresses to identify them. There are basically three modes of command signals that the Arduino UNO receives from the Raspberry Pi.

These are: 1) To send GPS sensor values acquired from the GPS, 2) To send the data received from the obstacle detector and 3) For maneuvering the car's direction of motion or state according to the command signal sent by the Raspberry Pi.

E. Arduino takes action according to the command

Based on the command received Arduino takes appropriate action. For example: acquiring GPS sensor value, acquiring obstacle distance sensor reading and maneuvering the car's direction of motion or state. The GPS sensor continuously pings for getting the actual location of the car. Arduino also pings the ultrasonic distance sensor for distance of obstacle before the car. Based on the commands, Arduino changes the direction and speed of the motors using the motor controllers.

F. Updates GPS position of the car

Whenever the Robotic Car is commanded to change its position, Arduino UNO polls the GPS sensor to get the updated GPS position and then when it is commanded to send the GPS position then this location is sent to the Data queue of the cloud service bus. This data is later received by the UWP application which updates the UI accordingly.

G. Sends acknowledgement to user

Whatever may be the command sent to the car, for every command there is a specific response which either represents that the command has been fulfilled or it has failed to fulfill the command. Usually the acknowledgement is represented as1 or 0. This is a crucially important feature in case of systems like this which is based on the Internet of Things paradigm as without this feature client is unable to realize whether the system has actually performed in the desired way or not.

IV. CONCLUSION

The mobiler robot is an important department of robotics and with the speedy development of associated era, it's miles toward the smart and diversified path, widely used, almost penetrate all regions. In this paper, an efficient method to multiple control system is incorporated with IoT. Controlling more than one devices in a couple of methods makes causes extra convenience in dealing with a device. The cloud service allows the device to reduce memory load. Stored messages are robotically eliminated after a positive amount of time. The overall performance outcomes prove that if the incorporation is energy enough, a couple of control strategies have less effect on time and performance compared to the single manner of the control device.

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