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Industrial Monitoring Android Robot Using Raspberry PI with Cloud Technology

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ABSTRACT:

In the existing method data's are stored and monitored in the computer memory and other hardware units. So it consumes lot of storage space, hardware unit and cost efficient. In order to overcome these disadvantages "cloud technology" can be implemented. This project focuses on implementing the Raspberry-pi controller to control the robotic movement with the help of Smart phone coupled with cloud interfacing so as to access and monitor all the information anywhere. Cloud robotics is a field of robotics that attempts to invoke cloud technologies such as cloud computing, cloud storage, and other Internet technologies centered on the benefits of converged infrastructure and shared services for robotics. Our project is a cloud robot which is used in industrial and manufacturing environment. It works on a ROS platform. Here we use Raspberry Pi controller to control the various devices attached to it. For testing this implementation, Android phone, camera, DC motor, sensors and a Raspberry pi controller have been used.

The movement of the robot is provided by DC motors and the direction is controlled from an android environment using Robot Operating System (ROS). The controller and the receiver end is connected by Wi-Fi. The data input from the gas, temperature or Infra Red sensors is given to the Raspberry Pi controller. A camera is used to provide visual input of the surrounding environment to the robot. The data obtained by the sensors and camera are processed by the controller and stored in cloud.

1. INTRODUCTION

Advanced robotics and autonomous/near-autonomous vehicles are two other disruptive technologies identified in the McKinsey study as having major impact in the long term.While the cloud computing paradigm was originally developed in the cyber world and applied software as a service.(SaaS), in the last few years it has been extended to the cyberphysicalworld, including vehicles like cars and people with smart phones, and robots like ground vehicles and unmanned aerial vehicles. A robot operating system (ROS) is a collection of programs which allows a user to easily control the mobile operations of a robot. In this system, the robot connected with cloud. So that we can access and monitor all the information from anywhere. The large amount of storage process is not needed by connecting the cloud. The Camera is used to given the input to the Raspberry pi microcontroller. We had made use of gas and Infrared sensors which monitors the Environmental conditions in industrial areas for safety purpose. The Wi-Fi is used to send the data from controller to Mobile using the IP address of the Raspberry-Pi kit. Using mobile we can also control the robot movement and viewing the movement. Finally the data's obtained in mobile is uploaded to cloud.

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Robot Operating System (ROS) is a collection of software frame works for robot software development providing operating system-like functionality. ROS provides standard operating system services such as hardware abstraction, low-level device control, implementation of commonly used functionality, message-passing between processes, and package management. The robot is connecting to the internet we can helpful for lot of advantages like powerful computation and memory storages. It also use for a massive Data resources. As explained before the Android device can also be used as a link to the cloud. So the Robot connected to the Cloud server it can make the use of some cloud services.

2. EXISTING SYSTEM

Wired devices are fixed to or near the machinery. These devices are wired to power supply. The lack of wireless system and large power consumption are the drawbacks of wired device.

3. PROPOSED SYSTEM

The practical example of this project is based on a low cost Robot with an embedded Android phone in a ROS environment. This project focuses on implementing the Raspberry-pi controller to control the robotic movement with the help of Smart phone coupled with cloud interfacing so as to access and monitor all the information anywhere. A Raspberry-pi controller is used in the robot to control its movement. The directions are controlled by an android device or computer using ROS. A Robot Operating System (ROS) allows a user to easily control the mobile operations of a robot. A Camera is used to give input to the Raspberry pi microcontroller. Fire sensor is used to sense the fire with the use of Raspberry Pi controller. An IR sensor is used to alert attempt to access restricted area. Wi-Fi is used to send the data fromcontroller to Mobile using the IP address of the Raspberry- Pi kit. Using a mobile, we can also control the robot movement. The monitored data will be sent to the cloud enabling access of information from anywhere.

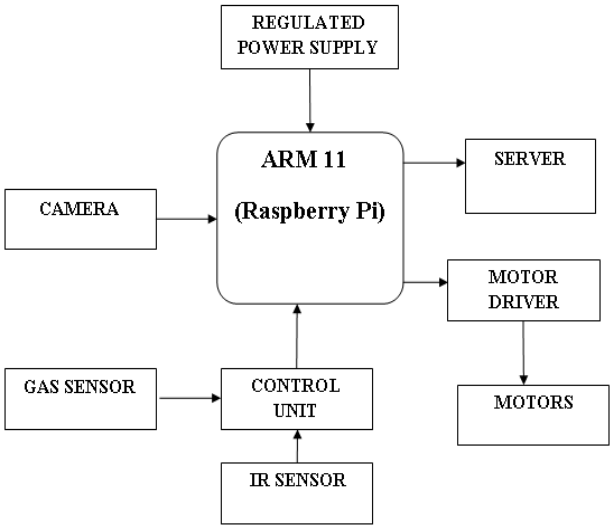

Fig. Block diagram

A. Raspberry Pi

Raspberry pi B is a portable, powerful and minicomputer. programmable PC that runs in open-source Robot operating system. The board consists of Video Core IV graphics processing unit (GPU), ARMv7-compatible quad-core one, 512 MB of RAM. It has a MicroSD to boot media and for persistent storage. One powerful feature of the Raspberry Pi is the row of GPIO -General Purpose Input/output pins along the edge of the board (refer Fig.1.1). These pins are a physical interface between the Pi and the outside world. At the simplest level, these are called as switches. Seventeen of the 26 pins are GPIO pins; the others are power or ground pins.

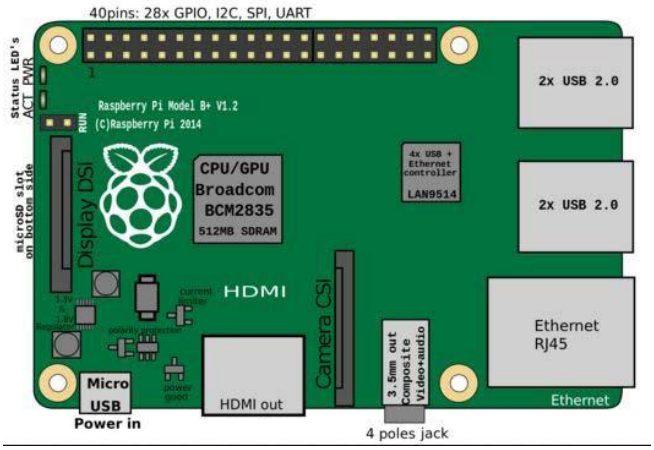

Fig. Raspberry Pi Board

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We have 4 USB 2.0 ports, compared to 2 on the Model B, and better hot plug and over current behavior. The old friction-fit SD card socket has been replaced with a much nicer push-push micro SD version. By replacing linear regulators with switching ones we've reduced power consumption by between 0.5W and 1W.The audio circuit incorporates a dedicated low-noise power supply. We have aligned the USB connectors with the board edge, moved composite video onto the 3.5mm jack, and added four squarely-placed mounting holes.

B.USB Camera

The type of camera used here is an USB camera which has recording function built-in and can thus record directly to any standard storage media, such as SD cards, NAS (network-attached storage) or a PC/server. The camera feeds or streams its image in real time to a computer or a mobile using network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via Wi-Fi. When sent to a receiver side, the video stream is saved in cloud.

C. Sensors

IR sensors are miniaturized IR receiver modules for remote control systems. The sensors detect the wavelength and spectral radiation of the light from the IR emitter. It provides high communication speed and high level of security. Gas Sensor is used in gas leakage detecting equipments the industry. It is suitable for detecting of LPG, iso-butane, propane. It had Small sensitivity to alcohol and smoke. Highlighting features include Fast response and Stable and long life. The sensor can be directly powered by DC supply or through a diver circuit.

D. Regulated Power Supply

There are several ways to convert an AC voltage into the DC voltage. Traditionally, this has been done with a transformer and rectifier circuit. However, in applications that involve providing a DC voltage to only the controller and a few other low-current devices, transformer-based or switcher-based power supplies may not be cost effective. So, Transformer less power supplies which provide a low-cost alternative to transformer-based are used in this robot.

E. DC Motor

The DC motor is connected to a set of four wheels and is responsible for the movement of robot. A DC motor is a class of electrical machine that converts direct current electrical power into mechanical power. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

F.Cloud

Cloud computing is a synonym for distributed computing over a network. Its highlighting feature is the ability to run a program on many connected computers at the same time. Its advantages proved in history include on demand self-service, ubiquitous network access, location independent resource pooling, rapid resource elasticity, usage-based pricing and transference of risk. Some of the Services offered by cloud include 'SaaS' (Software as a Service), 'PaaS' (Platform as a Service), 'IaaS' (Infrastructure as a Service), 'HaaS' (Hardware as a Service) and 'NaaS' (Network as a Service).

G. Wi-Fi

Wireless Fidelity or Wi-Fi is a local area wireless computer networking technology that allows the Raspberry Pi kit to connect to the network. It uses a bandwidth of 2.4 gigahertz. The Wi-Fi network provides the connection of unique IP address from the Raspberry Pi kit to the devices in receiving end. Using the various encryption technologies in Wi-Fi, the network is made secure. Wi-Fi is provided for the entire process which is fitted along with the robot. The power supply for all the components is provided by DC transformer less power supply. IR sensor signals if a person is trying to cross a restricted area and switches on the lamp. All the data obtained in mobile is uploaded to cloud.

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4. DEVELOPMENT AND RESULTS

The proposed system has been designed it contains Raspberry Pi and a sensor. One powerful feature of the Raspberry Pi is the Row of GPIO (General Purpose Input output) Pins. By using a python library to control the Raspberry Pi GPIO, set the mode of pin numbering to control the sensor. Raspberry Pi works on Linux Os and the software platform is python for dealing with monitored the environmental conditions (safety purpose). The Gas sensor and Infrared range has been monitored continuously Every 5 seconds. The data monitored has been updated to the fire cloud server with the help of Wi-Fi and continuous access from anywhere is feasible. The cloud server given a URL link address when create a own domain, by using a python program the URL link address and Wi-Fi IP address was connected then the output sensor data is updated through the cloud server. The updated sensor values can be viewed by its own Smartphone. Raspberry-pi controller with sensor interfacing for monitoring environmental conditions (safety purpose) has been implemented.. The data monitored has been updated to the cloud server with the help of Wi-Fi and continuous access from anywhere is feasible. The updated sensor values can be viewed by its own Smartphone.

5. ADVANTAGES

- Safety is ensured by the IR sensor. Unwanted access inside restricted area can be avoided.
- Provides immediate attention to over temperature and heat dissipation by turning on the cooling fan.
- Smoke, harmful gas can be immediately detected and alerted.
- Industry monitoring can be done from anywhere. Even from home.

6. APPLICATIONS

- The robot can be used in any kind of manufacturing and industrial unit.
- It can be effectively used in Nuclear power plants where human can be prevented from getting exposed to radiation.
- Using the robot in power grids will be efficient for monitoring the entire area.
- Many lives can be saved when used in chemical industries where there is utmost need to detect harmful gas leakages.

7. FUTURE SCOPE

By making the robot fly, the entire top view of the industry can be viewed. This will overcome the usage of CCTV cameras inside the industry. Security can be tightened by adding face recognition feature to the camera.

8. CONCLUSION

As demonstrated in this project, the practical application has been created. The gas and Infrared range has been monitored continuously by Every 5 seconds. The data monitored has been updated to the fire base cloud server with the help of Wi-Fi and continuous access from anywhere is feasible. The Proposed Method Contains the Raspberry Pi and a Sensor device. The data monitored has been updated to the fire base cloud server with the help of WiFi and continuous access from anywhere is feasible. Raspberry Pi Works on Linux OS and the software platform is Python for dealing with monitored the environmental conditions. Then the output sensor data is updated through the cloud server. The updated sensor values can be viewed by its own Smartphone. The robotic movements can be controlled using android application in smart phone. There are 4 touch buttons are available in the application (Forward, Backward, Left, Right) for control the robotic direction or movement. Raspberry pi receives the input from camera module.

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