Remote Programming of Microcontroller Using Raspberry Pi on A Prototype Robot

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Abstract- *The objective of this paper is to remotely program a microcontroller that is used to control a robot. Wholly this system consists of a computer system, a microcontroller and hardware required for the multi-function robot. The robot is used just to demonstrate the change of program in microcontroller. The robot is a multi-function robot, which will act as 'line follower' or 'obstacle avoider' depending on the program uploaded from the client end. The purpose of the remote programmable system is that it can be used to update programs of embedded systems remotely, without being physically present via internet. And to assign multiple functions to a single embedded system.*

Keywords- Microcontroller, Raspberry pi, Atmega328, Robot.

I. INTRODUCTION

Due to continuous development and progress in the field of embedded technology, the demand for advanced solutions to day-to-day problems also increased. Today almost every electronic device is becoming connectionless. Wireless technologies are more convenient and hassle-free. But programming of Microcontroller still requires physical connection with the computer. This project overcomes the compulsion of physical presence, and the need of plugging and unplugging of controller to the PC for updating its program. The examples of wireless technologies are- GSM, Bluetooth, Zigbee, RF transmitter & receiver, Wi-Fi. Out of these mentioned technologies Wi-Fi proves to be the best as it allows connecting with internet. In GSM, Bluetooth, Zigbee and RF the maximum distance of communication is confined. Whereas internet is a global platform. In recent years internet of things has become very popular. IOT has been implemented in fields like agriculture, automobiles, industries, home automation, military.

In addition to other IOT applications, this system gives a way of remotely programming microcontrollers, where a prototype of multi-function robot is set up with the help of Raspberry pi which can program any microcontroller attached to it if it is pre-defined and set up properly. The system would prove to be useful in embedded consumer products, to update and improve the functioning of the system.Today each and every microcontroller product is evolved from its older version, i.e. engineers have improved them. For e.g. Air conditioners earlier didn't have timer function, auto off, Bluetooth control and Wi-Fi. Similarly in this paper we are trying to improving the traditional flashing method. It Burns the program into microcontroller used in any system from any part of the world, through internet. We can update the program as many times as we want and we can change its functions and applications as well, provided it is connected with its output devices. One single system should be able to carry out multiple functions, which will also save cost and size of storage.

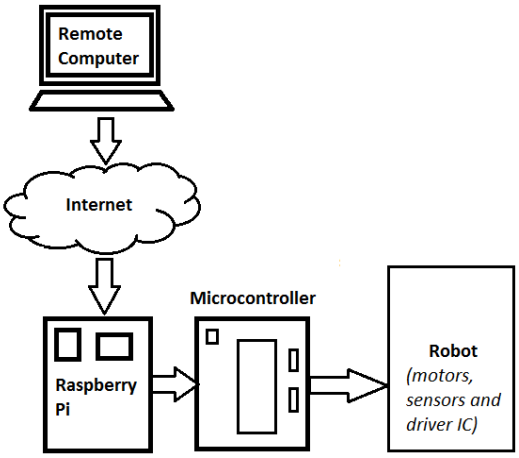
II. LITERATURE SURVEY

1. 'A remote lab for industrial robots' dated Nov 6, 2001.
   It was for teaching students and solving industrial problems.
   They performed experiments on mechanical robots.
2. 'website based remote lab for controllers' presented in the year 2008.
   They prototyped a system to teach microcontroller experiments to the students remotely.
   They used a website to give access to the students for performing experiments.
3. 8051 internet based 'in system programmer' dated 17 Feb 2015.
   They fabricated a circuit with Ethernet compatibility and in system programming option.

III. BRIEF SKETCH

The following block diagram shows a brief sketch of the system. It consists of the following basic blocks:

1. A remote user's PC
2. A Raspberry Pi
3. Any Microcontroller
4. Robot Sensors, Motors, Driver circuit and LEDs
5. Internet connection



About Raspberry Pi: It is nothing but a debit card sized small CPU. Its similar to our conventional desktop PCs. It has on board ARM processor, Graphic processor, memory, USB slots, Ethernet, Wi-Fi, Bluetooth, HDMI output, audio jack, etc.

IV. VIRTUAL NETWORK

The proposed idea is to establish a virtual network over internet. By implementing VNC which is virtual network computing, we will be able to fetch the screen data from one PC to another. The sharing of the screen data and mouse or keyboard's output is shared. In short, the CPU of Raspberry pi will be used by another remote PC on its personal monitor. Raspberry Pi's hdmi port will be unused.

V. ADVANTAGES

1. **Low cost:**-As the price of Raspberry pi is quite economical the overall cost of the project is very low.
2. **No Physical presence:**-Since it a remote access system, one does not need to be physically present near the controller, i.e. it can be used from anywhere via internet.
3. **Minimum power required:**-Power requirement of Raspberry Pi and controller is 5 volts dc only.
4. **Easy to upgrade:**-New and improved programs can be uploaded remotely at any time to improve the performance of the system.
5. **Easy to install:**- The programming language is easier to use which makes the installation of the system quite easier.
6. **Easy to maintain:**- The hardware used is economical therefore the maintenance cost is also very less.
7. **Safe:**-As only 5V dc power is being used, the system becomes easy and safer to operate.
8. **No plugging and unplugging:**-Plugging and unplugging of microcontroller with raspberry pi is not required, during each burning process. Also does not damage the ports.
9. **Multiple functions:**-Multiple functions can be given to same system or hardware by burning different programs. Reduces hardware requirement. Thus cost also reduced.

VI. CONCLUSION

This project report shows a new way of remotely programming a microcontroller that is used to control the robot. It has large number of advantages over traditional practices. For demonstration purpose a multi-function robot is used. It changes its functioning from 'line following' to 'obstacle avoiding' or vice versa.

VII. ACKNOWLEDGMENT

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