INTERNET CONTROLLED CAR

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Abstract—An existing remote-controlled machine will be designed according to the following project plan: The control will be carried out via Wi-Fi, and the order will be made from a web page hosted by the ATmega164 microcontroller. The control of the engines of the car will be done using a DC-DC converter with the H-bridge. The power supply of the assembly will be realized with the help of 4 1.5 V AA batteries, connected in series. The Wi-Fi connection will be provided by an ESP-12F module that will allow the microcontroller access to the Internet network. The circuit will be designed on a printed wiring board, designed with the Eagle software, and the software development of the project will be carried out in the Atmel Studio environment. To control the direction of the car will be used two DC motors, the one in front for the left-right direction and the rear one for the front-rear steering. The front-engine is equipped with a mechanically driven mechanism, which will move after the engine is actuated and will move planetary for the left-right direction. The functions of the car, compared to the existing one that could only be controlled by the remote control, are the movement in the four cardinal points according to the orders received from the web page, as well as the illumination of the road by lighting the headlights in front. Also, on the web page, you can see in real-time the battery voltage level.

Keywords—IoT; Wi-Fi; Bluetooth; remote-controlled machine; ATmega164 microcontroller; DC-DC converter; DC motors

I. INTRODUCTION

Internet has become an essential part of our lives. Most rely on the Internet to perform their various tasks, to make their lives easier. In fact, most people use a device connected to the Internet. The Internet has multiple purposes from entertainment to data processing, task solver, process automation, education and others. Recently, a new technology, called the “Internet of Things” has begun to make room in people’s lives to facilitate their various activities, without them getting too tired. The Internet of Things (IoT) can be classified as consumer IoT or industrial IoT is a new technology model envisioned as a global network of devices capable of communicating with each other. The IoT is generally accepted as one of the most important fields of future technology and is gaining vast attention from a wide range of industries. [1]

One of the utilities of the Internet of Things is the remote control of certain electronic devices. This proves useful in many areas, such as army, agriculture and more. For example, if we want to send an electronic car (or robot) to a hard-to-reach place, such as under the rubble of a house devastated by an earthquake or other calamities. Or if we want to control a military device to spy on the enemy's activity. In short, the advantage of a remote-controlled car is to reach areas where the man cannot, does not want or is not recommended to arrive. The objective of the project is to make a machine that can be controlled remotely through a web page. The Internet connection will be provided by a Wi-Fi module, and for controlling the steering of the car two DC motors will be used. Thus, with the help of the web page, the car can be moved to the four cardinal points or the headlights can be lit to illuminate the road. In addition, on the web page you will be able to view the battery voltage level in real time, to know when they need to be changed.

This paper is organized as follows. Section 2 outlines some related work. The proposed Internet controlled car is discussed in section 3. Finally, a brief conclusion is given in section 4.

II. RELATED WORK

Any mechanical-electrical system using a microcontroller that controls the motion of the system is a mechatronic system. Due to wireless and wired communication development any internet connected devices, no matter of the geographical position, can be controlled and the data can be extracted. One of the emerging fields is the one of internet controlled cars.

There are many designs of Internet controlled cars, as follows:

We begin with the example of the wireless controlled cars for which the internet is the communication medium. The controls for moving left, right, forward, and accelerated motions are received from a host computer by pressing certain buttons on the computer keyboard. For only straight-line movement the fast speed would normally be selected. When the motor is running, but the vehicle is unable to move, an emergency slip clutch protects the drive motor. We can also activate with a button on the keyboard of the host computer the braking system of the machine. For visual feedback, a video camera is placed on the vehicle. On to the screen of the computer, the video image, as seen through the video camera, is projected. The direction of the camera about the front of the vehicle is indicated by an arrow on the computer screen. Each machine and computer is equipped with a device to connect to one of the wireless services. The network service providers for computers and vehicles don’t have to be the same. [2]

The second example is Bluetooth and Wi-Fi Controlled Rescue Robot. It has been suggested a small sized robot equipped with a camera, as an efficient device for locating the survivors hidden inside the debris. Such a robot when manually controlled by any human either through a computer or a mobile phone, can easily tell the exact location of any human body by
streaming video over to a server. The location of a human body can be of utmost importance as it hastens the rescue by giving the exact location for digging and thus preventing the unnecessary hit and trial method of searching the victims. Therefore, the proposed robot can be modified and used for exploring a certain area, locating the bodies on a map and telling the way to reach them. [3]

Another example which is already implemented is a robot-controlled car using Wi-Fi module. The robot car can be easily moved from one place to another and added a camera can be used to record certain situations or to provide a better understanding of a given context to the one that operates it. Also, the robot car can be used to perform task remotely like moving or transporting physical things from one place to another. [4]

The final example is a remote-controlled car using wireless technology. The authors proposed a Wi-Fi controlled car using a mobile device. Some of the objectives are to extend the range of a standard radio frequency car using Wi-Fi technology and also to create a ubiquitous technology for cars that operate in daily life using a control system. Although the controlled machine can move in any direction, the performance depends on the signal strength of the device, where the maximum test range is only about 20 meters away from the user's location [5].

III. THE PROPOSED SYSTEM

The control circuit is based on the ATMega324A microcontroller, running at the frequency of 16 MHz. It has a 32KB flash program memory and a 2KB SRAM memory. It has numerous communication buses, such as UART, SPI, I2C. It also supports ISP programming and JTAG debugging.

This work also utilizes an ESP8266 Wi-Fi module. The ESP8266 Wi-Fi module facilitates communication through the Wi-Fi protocol with the local network, respectively with the Internet (web page for orders for directions). Its programming was chosen not by commands from the microcontroller, but by firmware flash directly from the computer, because Wi-Fi passwords cannot be set differently.

For power supply it will be used 3 batteries 18650 lithium ion rechargeable that will supply 11.1 V. The rechargeable lithium-ion battery has been widely used in mobile communication and portable instruments due to its many advantages. The batteries can be recharged with the help of Universal Li-Ion Charger for 18650 batteries with 2 ports MS-282AX. The advantages involve high volumetric and gravimetric energy density and low self-discharge rate. In addition, it is the most promising candidate as the power source for electric (hybrid) vehicles and stationary energy storage. [6] A voltage regulator will generate an output voltage of 3.3 V for supplying the circuit.

The proposed circuit also contains 2 DC-DC motors that are powered directly from the voltage given by the batteries. Specifically, two brushless DC motors will be used. This type of motor produces a magnetic field in the rotor using permanent magnets attached to it, and the inductive windings are on the stator. Switching is done electronically. They are generally smaller, but more expensive than conventional brushless DC motors, because they use "Hall effect" switches in the stator to produce the rotation sequence of the stator field, making the control more complex. They have better speed characteristics, are more efficient and have a longer service life than types with equivalent brushes. [7] The figure below (Fig.1) represents the structure of the brushless motor.

A Schottky diode is used for circuit protection. If the power wires are connected in reverse, the circuit is protected due to the fact that the diode will act as an interruption, preventing the wrong supply. Because the current passing through the diode is a significant one (up to about 1 Ampere ignoring any possible expansion of the circuit), a Schottky type diode was chosen due to the voltage drop lower than a conventional silicon diode, at the same value of the current passed. These significant voltage drops, at a sufficiently high current, would have caused significant, undesirable heat dissipation.

The driver DRV8833 in H bridge will generate the required energy for the motors for operation in both directions. The driver also has an energy save mode that can be accessed by modifying a logical signal from the microcontroller.

This project uses the UART communication protocol. UART (Universal Asynchronous Receiver Transmitter) that is one of the serial communication protocols. UART is used in applications where it is a need for short-distance, low speed, low-cost data exchange between computer and peripherals [8]. In this project, the UART module represents an intermediary between the host computer and microcontroller. Furthermore, the microcontroller can send data to the cloud and blockchain [9].

![Fig.1 Structure of the brushless motor][7]

![Fig.2 ESP8266 internet connection][262]
Thereby, the ESP8266 Wi-Fi module communicates through UART protocol with integrated circuit MCP2200 and MCP2200 communicates through USB with host computer. The integrated circuit MCP2200 represents a conversion module from USB to UART. Fig. 2 explains how the Wi-Fi module it's connects to the internet network.

The components were chosen taking into account the cost and compatibility between them with each other.

For both the layout of the circuit and the layout of the printed wiring board, the Autodesk EAGLE application, version 8.6.3, it will be used. EAGLE (Easily Applicable Graphical Layout Editor) contains a schematic editor for designing circuit diagrams. The schema is stored in files with the .SCH extension, the parts are defined in the device libraries with the .LBR extension. The circuit sections can be placed on several sheets and connected through ports.

The PCB layout editor stores the onboard files with the .BRD extension. This allows annotation back to the schema and automatic routing to automatically connect rates based on the connections defined in the schema. EAGLE saves Gerber and PostScript files as well as Excellon drill files. These are standard file formats accepted by PCB manufacturing companies, but given the typical EAGLE user base of small design firms and hobbyists, many PCB and assembly factories also accept EAGLE files (with the .BRD extension). To optimize pick-and-place data, as it sees fit. The reason for choosing this software package for the realization of the project was both the familiarity we had with the program, from the previous electronic projects, and the fact that Autodesk company offers full licenses for the academic environment for free (so the board was not limited by spatial dimensions point of view).

The following figure (Fig. 3) represents the Printed Circuit Board of the project.

![Printed Circuit Board](image1)

The figure below (Fig. 4) is the block diagram of the entire system.

![Block Diagram](image2)

The coverage distance for remote control is 30 meters, the computer on which the travel commands are given and the Wi-Fi module on the electronic car must be connected to the same network. The command-execution delay is about 0.8 seconds, delay small enough for the car to brake in time. The actual movement of the laboratory vehicle and for turning on and off the headlights can be done by pressing the arrows on the keyboard or by using the mouse on the web page.

IV. CONCLUSIONS

This article tried presented a prototype vehicle that can be controlled remotely by an operator using a web-page medium. The commands are sent to the vehicle using data packages exchanged via Wi-Fi. The dimensions and type of electronic components in the wiring diagram (resistors, capacitors, diodes, transistors) were chosen according to the recommendations in the catalog sheets and the working frequency.

As future work directions, the following should be taken into consideration: the existence of alarms set in case the battery voltage drops below a certain percentage or the installation of a video camera and displaying images on the computer screen. Also, machine learning components can be added to automatically avoid obstacles.

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