Remote Monitoring System based on a Wi-Fi Controlled Car using Arduino

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***Abstract*— Developing surveillance and monitoring systems can be quite challenging at times since the systems should be designed with consideration of the environment to be monitored. Good surveillance systems need to have dynamic features, e.g. monitoring cameras that are mobile can move around the area being monitored. Monitoring a large area would also be a challenge for the security officers, as they will need to spend too much time to patrol covering all places. Other scenarios that require dynamic surveillance systems include dangerous areas, e.g. areas with explosion and fire risk, or those contaminated with toxic gases. Another use case includes areas that cannot be accessed by humans. To address these challenges, we propose a dynamic monitoring system based on a Wi-Fi remote controlled car. Users can be in the next room, the next building, or even in another country while controlling the movement of the car via the Internet. Some sensing mechanism is needed to help the user to locate the current location of the car and effectively navigate. This system is using Wi-Fi as the only communication medium to connect the car to the server.**

I. INTRODUCTION

A monitoring and surveillance system is usually designed and built based on the characteristics of the area to be monitored. For example, areas that are too dangerous for humans to operate in require a dynamic monitoring system to act in place of a safety officer. This includes areas in which flammable liquids or gases present in excessive quantities can easily lead to an explosion or fire. Monitoring and surveillance operations in large buildings also require a dynamic control system. A large building is usually monitored by a team of security officers. There may be times in which some of the team will leave the control room to patrol from one level to another. Concerning the scenarios described above, in this paper we present a mobile monitoring prototype employed on a Wi-Fi remote-controlled (RC) car. The RC car is driven by a Arduino and remotely controlled by the user via the Internet. In general, this prototype exploits the concept of Internet of Things (IoT).

II. DETAILED DESIGN

The main hardware components running on the RC car were connected as shown in Fig.1. These include the Arduino, USB Webcam, Wi-Fi module, L298 Dual H Bridge Motor Controller, and RC Car. Each component is illustrated in Fig 1.

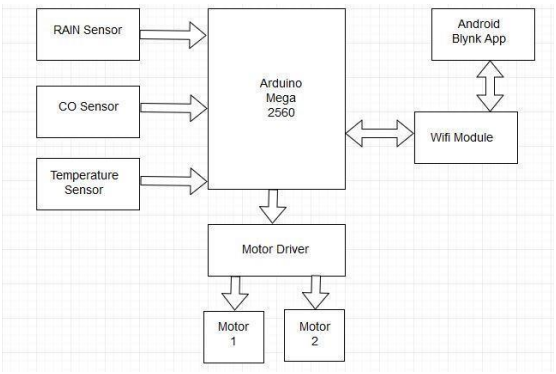

Fig 1: Block diagram

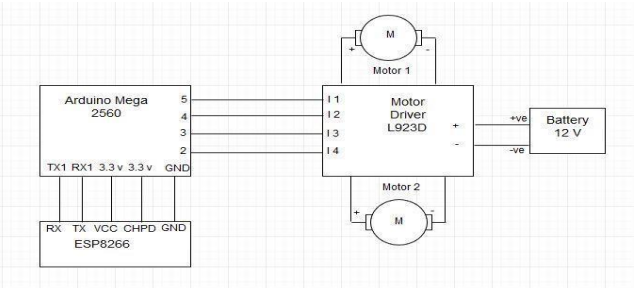

Fig 2: Car movement Circuit Diagram

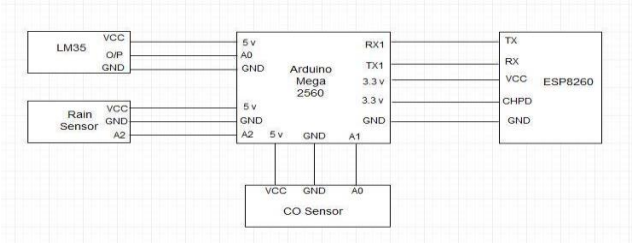

Fig 3: Sensors Circuit Diagram

III. HARDWARE AND SOFTWARE DESIGN

The RC car consists of two motors, which control the front wheels; turn left or turn right, and the back wheels; moving forward or backward. L298N H-Bridge is used to control both motors on the RC Car. The RC car uses 3 AA batteries as its power source. In this project, the power source used

will be separated for both L298N and the Arduino. However, it is possible to power up both L298N and Arduino controller using one source. The connection between the RC car and the L298N H Bridge is shown in Fig. 4.

Fig 4: Connection between RC car and L298N H Bridge

IV. OVERVIEW

An overview of the prototype design will first be presented followed by some details on the proposed algorithm. For connection to the server, the system will rely on a Wi-Fi network which allows data to be transferred to and from the Arduino to the web server. The Wi-Fi allows the RC car to access the Internet at broadband speeds once connected to an access point (AP), or in ad hoc mode. Wi-Fi has been chosen over Bluetooth since Wi-Fi have all specifications needed for this system. For instance, Wi-Fi allows some security measure to be imposed if needed, e.g. a user that is not connected to the same network, as the Arduino will not be able to control the RC car via the Android Phone.

a) Arduino**:** The Arduino mega is a microcontroller board based on the ATmega2560. Arduino is an open-source, prototyping platform and its simplicity makes it ideal for hobbyists to use as well as professionals. The Arduino mega has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "mega" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Arduino mega and version 1.0 will be the reference versions of Arduino, moving forward. The mega is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform. The Arduino mega is one of the latest smart microcontroller unit and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 --(RX) for receive the data and pin no.1 (TX) for transmit the data. An ATmega2560 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .inf file is required. The Arduino software includes a serial monitor which allows simple

b) RC car Motor Controller**:** For controlling the RC car movement, L298 Dual H Bridge motor controller is used, specifically to control motors speed and direction. The controller can also be used for other purpose such as driving the brightness of lights, e.g. a high-powered LED array.

c) Power Supply**:** Arduino can be powered from a 5V micro USB supply, where the amount of current needed is dependent on the type(s) of component(s) connected to the Arduino. However, the ideal amount of current to run the Arduino is 1.2 Ampere For this prototype, the power supply used is a Pineng Power Bank, providing 2 amps and 5V. A fully charged power bank is able to support the Arduino for approximately about 1 day and 4 hours (28 hours).

d) Remote Controlled (RC) car**:** For this project, the RC car used has dimensions of 18cm x 11cm x 10cm, scale of 1:24. It requires 3 AA batteries and has 2 motors that control the forward, backward, left and right movements.

e) Arduino Software IDE**:** Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package. The Arduino software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Libc to compile programs, and for uploading the programs it uses avrdude. As the Arduino platform uses Atmel microcontrollers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino.

f) Rain Sensor**:** The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer.

The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

g) Temperature Sensor**:** An analog temperature sensor is pretty easy to explain, it's a chip that tells you what the ambient temperature is! These sensors use a solid-state technique to determine the temperature. That is to say, they don't use mercury (like old thermometers), bimetallic strips (like in some home thermometers or stoves), nor do they use thermistors (temperature sensitive resistors). Instead, they use the fact as temperature increases, the voltage across a diode increases at a known rate. (Technically, this is actually the voltage drop between the base and emitter - the Vbe - of a transistor. By precisely amplifying the voltage change, it is easy to generate an analog signal that is directly proportional to temperature. There have been some improvements on the

technique but, essentially that is how temperature is measured. Because these sensors have no moving parts, they are precise, never wear out, don't need calibration, work under many environmental conditions, and are consistent between sensors and readings. Moreover, they are very inexpensive and quite easy to use.

h) WIFI Module**:** The ESP8266 WiFi Module is a self - contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost- effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions and requires no external RF parts.

i) CO SENSOR**:** The MQ7 is a simple-to-use Carbon Monoxide (CO) sensor suitable for sensing CO concentrations in the air. It can detect CO-gas concentrations anywhere from 20 to 2000ppm. The sensitivity can be adjusted by the potentiometer.

V. RESULT

Prototype development work has been carried out with an RC car. The RC car is driven by an Arduino, which has a Wi-Fi access to communicate with a web server. A motor controller is also attached to the Arduino to control the movement of the RC car. RC Car is controlled by Android phone ..which include Blynk application, the user is able to navigating the area by remotely controlling the car's movement. For power supply, the Arduino is connected with a 37 wh power bank that delivers 5v and 2.1a, while the RC car is powered up by 3 AA batteries.

VI. FUTURE SCOPE

The Remote monitoring system based on a WIFI controlled car using Arduino can be implemented in Military services for guiding a soldier and also to use as a detector to detect Land mines by using suitable detectors. We can also fix a bullet loaded gun instead of waiting for a person by himself to come front. It can also used in Mining area to sense for poisonous gases or to search for someone who is missing in the place of mining.

It can used in these area with some fire proof or water proof material if necessary.

VII. CONCLUSION

This paper presents the development work of remote monitoring prototype system using a Wi-Fi controlled RC car driven by an Arduino. The different hardware components and their assembly were described and a few studies were conducted to explore ways on how the components can be integrated to communicate with a web interface. The Android phone acts as the viewer, either to provide surveillance view or to guide the user while remotely navigating the car. The user is provided with the navigation controller panel to allow control of the RC car movement. With a fully functional prototype, this project may be used for monitoring purposes in a building, in a hazardous area and other such locations. Several improvements can be made to enhance the capability of the project.

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