Remote Area Monitoring Robot

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Abstract

Remote areas are the areas which are not available for the easier accessing of people. To monitor those areas a robotic vehicle is designed which can also measure the environmental parameters in that area. The robotic vehicle is provided with a camera module to obtain the real-time image of the remote area. Temperature and humidity sensors are fitted to the vehicle to measure the parameters in the surrounding area. The control of these units is done with the help of the Arduino board.

Keywords: Arduino Board, Motor shield, RF Camera Module, DHT11 Sensors

I. INTRODUCTION

There are many places where monitoring is needed without the human intervention. Forest fire is one of the highly affecting natural disasters which occur in remote areas like forest. Forest fire has led to loss of many natural resources and it is also hard to shut it down when it gets severe. In order to monitor such locations a robotic vehicle is needed.

The objective is to design a robotic vehicle to monitor the location continuously. The power supply for the robot is provided with the help of lead acid rechargeable battery. The sensor measures the humidity and temperature of the surrounding so that the environmental changes can be measured and monitored.

II. PROPOSED SYSTEM

The objective of this paper is to ensure monitoring of remote areas without the intervention of human. It also focusses on detecting the temperature and humidity changes in the surrounding area.

A. ARDUINO:

An Arduino is an open source platform for building electronics projects. It consists of both the microcontroller and IDE (Integrated Development Environment) used to write and upload computer code to the physical board. Unlike other programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load a new code to the board – you can simply use a USB cable. And also, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of micro-controller into more accessible package.

B. MOTOR SHIELD:

Adafruit designed shield called "Adafruit Motor Shield" was a useful shield with older components. In 2014, Adafruit has discontinued this shield and launched a much better motor shield. The shield contains two L293D motor drivers and one 74HC595 shift register. To control the direction of motor drivers the shift registers expands 3 pins of Arduino to 8pins.
To increase the maximum current, the L293D allows extra chips with "piggyback". Piggyback is soldering one or two or three extra L293D drivers on top of the L293D drivers on a board to increase upto maximum current. The L293D allows parallel operation. The Motor Shield can drive 2 servo motors, and it has 8 half-bridge outputs for the 2 stepper motors or for 4 full H-bridge motor outputs. The servo motors utilizes +5V supply from the Arduino board. The voltage regulator on the Arduino board could get hot.

C. Bluetooth Module:

HC05 module is designed for transparent wireless serial connection setup. This Module can be used in Master or Slave configuration, making it a great solution for wireless communication. This type of serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver. It uses CSR Blue core 04-External single chip Bluetooth system with a CMOS technology and with Adaptive Frequency Hopping Feature.

This is a MASTER/SLAVE module. By default it is SLAVE. The slave modules cannot make a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. It is simply used for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc.

D. DC Geared Motor:

At first a motor is an electromechanical device used to convert electrical energy into a mechanical energy. Here the motor used is a DC geared motor of 150rpm and supply voltage of 12V. The DC geared motors were used for it stable and steady movement that is suitable for an industrial robot.

E. Sg90 Servomotor:
Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (with 90 in each direction), and works just like the standard kinds but smaller. Any kind of servo code, hardware or library can be used to control these servos. Good for beginners who want to make move without building a motor controller, especially since it will fit in small places.

It is a sensor which able to detect the presence of nearby objects by without any physical contacts. These sensors emit electromagnetic radiation and wait for the changes in field or return signal. And the maximum distance detects by a sensor is “nominal range”. Proximity sensors are used in mobile phones and to recognize air gestures and hover-applications.

E. Humidity and Temperature Sensor:
DHT11 features a temperature & humidity sensor complex with a calibrated digital signal output. It has high reliability and excellent long-term stability.

This sensor includes resistive-type humidity measurement component and a NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, and cost-effectiveness. Each DHT11 elements are strictly calibrated in laboratory with accurate humidity calibration.

The small size, low power consumption and 20-meter signal transmission making it the best choice for various applications. The components is a 4-pin single row pin package. It is convenient to connect and special packages can be provided per users’ request.

F. Wireless Camera Module:
The camera is powered by a 9V battery and used to transmit wireless audio and video to the receiver. The range of transmitting and receiving is 50-100 meters. The receiver can output the video to a computer through suitable USB AV converter.

III. BLOCK DIAGRAM

A. Android Application:
Android is a mobile operating system developed by google, based on Linux kernel and designed primarily for touchscreen mobile devices. The version history of the Android operating system began with the release of the Android alpha in November 5, 2007. The first commercial version, Android 1.0, was released in September 2008. The latest version of android available is naugat 7.0 – 7.1.1.

B. Bluetooth Controlled App:
This is an application used in this paper for giving instructions from android phone to the microcontroller. The instructions are transmitted and received by Arduino through the Bluetooth device HC-05. These instructions that are given by the user through android phone is used to control the movement and the direction of the robot. Moreover, these apps are open source and it can be used with the programming skill in Arduino platform.
Table – 1

<table>
<thead>
<tr>
<th>COMMANDS</th>
<th>CHARACTERS</th>
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<tbody>
<tr>
<td>Forward</td>
<td>F</td>
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<tr>
<td>Back</td>
<td>B</td>
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<tr>
<td>Left</td>
<td>L</td>
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<tr>
<td>Right</td>
<td>R</td>
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<tr>
<td>Forward Left</td>
<td>G</td>
</tr>
<tr>
<td>Forward Right</td>
<td>I</td>
</tr>
<tr>
<td>Back Left</td>
<td>H</td>
</tr>
<tr>
<td>Back Right</td>
<td>J</td>
</tr>
<tr>
<td>Stop</td>
<td>S</td>
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</table>

Based on the above command the following Switch cases are made in programming and these commands are switched based on the command given by the user through the android app.

### C. Program Explanation:

The project coding was developed after learning the basics of C language and various basic coding from the online source. Separate parts of coding for sensors like DHT11 (humidity and temperature), LM393(LDR), HC04(ultrasonic sensor), HC05(Bluetooth module), Servo motors were made. The servo motors were interfaced with LM293 Motor shield for control in the overall process.

To operate the various sensors and get the values, sensor library function zip file was added while executing the program.

The program provided above is the final program which contains the operating of the sensors, motors and all the necessary accessories.

### IV. OUTCOME OF PROJECT

#### A. Result:

Every part of the robot was analysed before assembling. The programmed speed and flexibility of these controllers make this robot more ideal for future research. This remote robot can move in any kind of terrain and it is very useful in surveillance, monitoring and can be used in military aspects. The size of the robot is more compact and it plays an important role in monitoring purpose.
V. CONCLUSION

The remote area monitoring Robot has been successfully designed. The speed of the robot is controlled by using an android app. This robot will be very helpful for the field engineers to improve and monitor the working environment. This paper concludes the measurement and monitoring of the Humidity (moisture content) and Temperature present in the working environment of an industry. The outcome of acquiring humidity and temperature is to identify the nature of the working environment and to safeguard the life of the workers and operators from major accidents. This paper can further be enhanced by considering a larger area of field under study for implementation purposes.

REFERENCES