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Video Capturing Robotic Car Controlled with MATLAB based GUI

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***Abstract*—With the advancement in science and technology, there has been an exponential increase in demand in the field of wireless communication. The drawback of wired communication is the high cost of materials which can be overcome by wireless communication. This paper presents the implementation of a MATLAB based graphical user interface (GUI) to control the movement of a robotic car. The commands to move the car in forward, reverse, right and left directions are sent from the GUI and processed by Arduino Uno board. The signals from the Arduino are sent to the car via RF transmitter and received at RF receiver after being decoded by the decoder mounted on top of the car. This paper can be used in remote locations for the capturing of video data to be used to surveillance or research.**

***Index Terms*— Arduino, MATLAB GUI, Surveillance.**

I. INTRODUCTION

Human surveillance can b achieved by deploying personnel near sensitive areas to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible. There are also added risks of losing personnel in the event of getting caught by the enemy. With advances in technology over the years, however, it is possible to remotely monitor areas of importance by using robots in place of humans. Apart from the obvious advantage of not having to risk any personnel, terrestrial and aerial robots can also pick up details that are not obvious to humans. By equipping them with high-resolution cameras and various sensors, it is possible to obtain information about the specific area remotely.

While developing human-robot interfaces, the developers need to be aware of the technical knowledge of the end users. Furthermore, compatibilities of the designed interface with the robot and the operator are crucial and should get enough attention. A surveillance robot can be used to monitor the environment and conduct rescue work. In this research work, Surveillance robot has been designed for the purpose of observing an accident situation and to assist the rescue personnel Surveillance Mobile Robot Presently, an intelligence surveillance system is in high demand where the traditional ways of the monitoring system which use CCTV results in an ineffective image due to its static position. Several projects have been done to overcome the problem, and one of the basic ideas is developing a mobile surveillance robot [1][2][3][4][5].

This paper presents the implementation of a MATLAB based graphical user interface (GUI) to control the movement of a robotic car. The graphical user interface (GUI) addresses the human-robot interaction issue associated with control of a robotic manipulator that is capable of maneuvering the vehicle. The direction in which the car is expected to move is directed from a GUI and processed by a transmitter board and other side

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receivers it and signal the motor using L293D motor driver. With the advancement of robotics technology, robots are getting closer to human beings, and the human-robot interaction has become a significant concern. As one of the most critical elements, the human-robot interface determines the quality of interactions between human and robots.

The work carried out for this paper are arranged as follows. The second section of this paper discusses the system architecture. The next section discusses the hardware implementation of the concept in discussion and the final section, the outcome is discussed.

II. System Architecture

The system architecture is primarily divided into two parts. The first part is the transmitter side and the second is the receiver side.

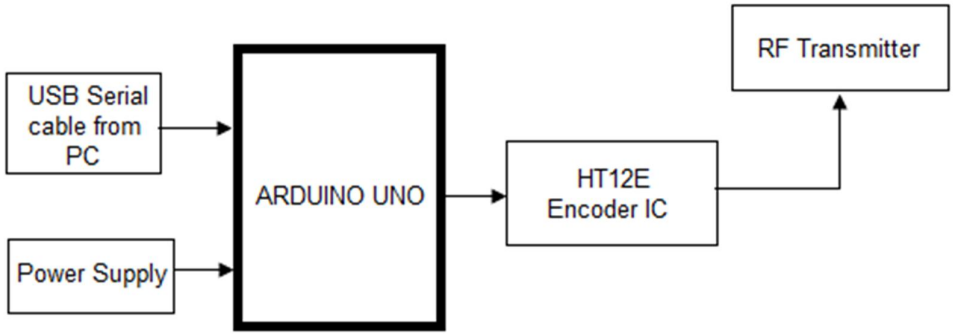

Figure 1. Transmitter side

The transmitter side is as shown in Figure 1. The input signal received from the PC is sent to the Arduino. The Arduino needs to be powered up y 5V. The information from the Arduino is encoded by an IC and is transferred to the receiver through RF transmitter. The data is input through the MATLAB GUI which interacts with the Arduino board which sends the data to HT12E encoder for converting the data into digital form is and transmitted to the receiver using RF transmitter.

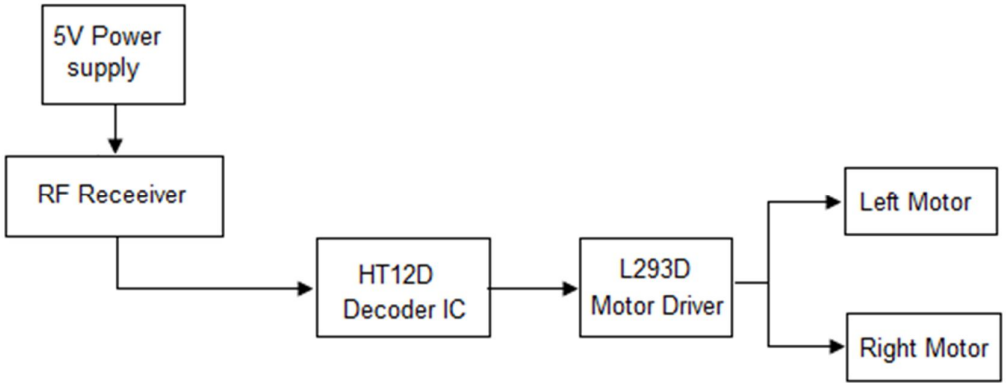

Figure 2. Receiver side

The receiver side is as shown in Figure 2. The RF receiver is powered by a 5v DC supply. The received information is decoded by the Decoder IC and is sent to the motor driver. The direction of the car depends on the inputs given to the motor. Based on this the left or right motor is activated. The RF receiver gets the signal from RF transmitter and sends it to the decoder which decodes the data in 0's and 1's and supplies to the respective motor according to the given logic i.e. a 1 1 will move the car ahead, a 0 0 will move the car behind etc.

Having established the circuit with no error in connection, the push to serial cable is attached to the laptop. It is necessary to check for which port is being used by the Arduino. After defining the port in the MATLAB code, press the run button. The expected result is that the GUI window opens as shown in Figure 3.

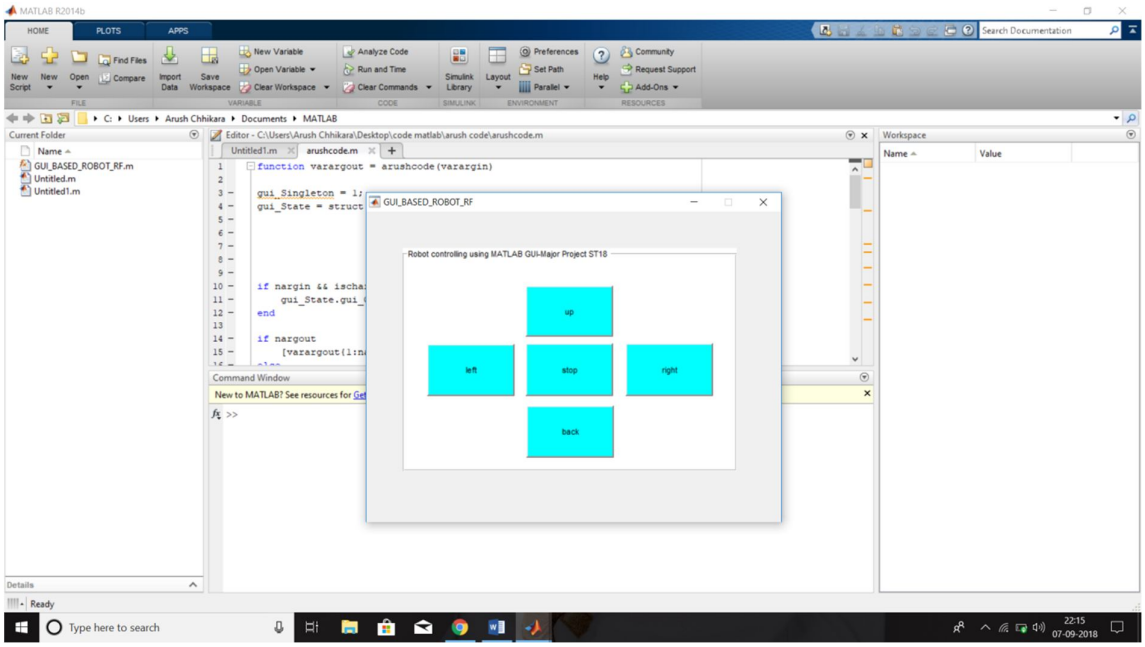

Figure 3. Project GUI

III. HARDWARE SPECIFICATIONS

Based on the system architecture discussed in the previous section, the suitable components are identified to execute the project. The brief of the various hardware components used in the paper is as explained in the following paragraphs.

Figure 4. REES52 Uno

The Arduino discussed in the paper is a REES52 Uno. It is a microcontroller board based on 8-bit ATmega328P microcontroller as shown in Figure 4. Along with ATmega328P, it the additional components such as crystal oscillator, serial communication, voltage regulator, etc. are used to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which six can be used as PWM outputs), six analog input pins, a USB connection, A Power barrel jack, an ICSP header, and a reset button.

The L293D motor driver is used in work carried out. This is a dual H-bridge motor driver integrated circuit (IC) that acts as current amplifiers. It takes a low-current control signal and provides a higher-current signal. This current will be more than 250 mA and can drive the motors.

The RF modules are 433 MHz RF transmitter and receiver modules. They are shown in Figure 5. When the transmitting logic is zero and the carrier frequency is fully suppressed, the transmitter will not draw any power and hence the battery consumption is recognizably low. When the transmitter logic is one, a signal is sent at 4.5mA and 3volts power supply. The serially transmitted data is received by the tuned receiver. The transmitter and the receiver are duly interfaced to two microcontrollers for data transfer. These RF modules can be used for Home automation, Car security system and short distance communication.

Figure 5. RF Module

HT12E and HT12E are used as encoder and decoder. The encoder is expected to maintain the speed, confidentiality, whilst maintaining the space constraint and standardization. Encoders are combinational logic circuits and they are exactly opposite of decoders. They accept one or more inputs and generate a multi-bit output code. Encoders perform exactly reverse operation than decoder.

The encoder will transmit the 12 bit parallel data into serial output through an RF transmitter.

The voltage regulator, IC 7805 is a fixed linear voltage regulator. The IC will maintain a constant output voltage by withstanding the fluctuations in the circuit. The IC is provided with a heat sink to dissipate the heat generated due to the difference between the input and output voltages.

In addition to the above-mentioned components, an Internet Protocol camera, also called an IP camera, is employed for surveillance.

III. Results and Discussions

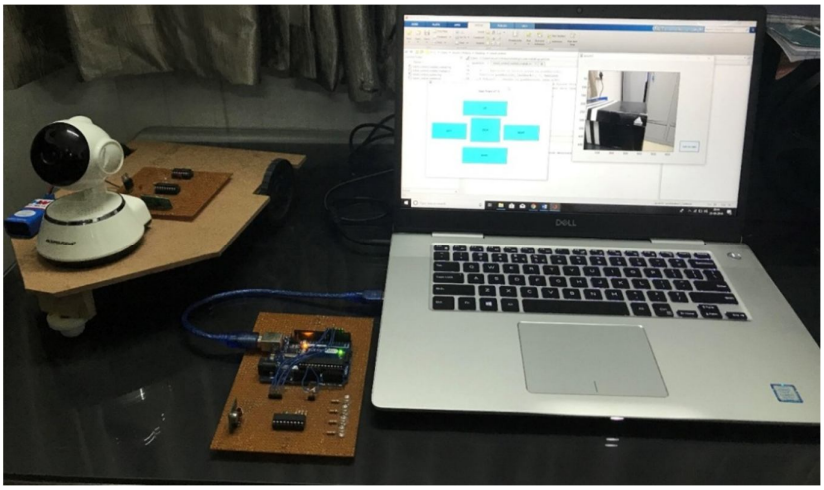

Figure 6. The Final project model

A Video capturing robotic car controlled with MATLAB based GUI is developed and is as shown in Figure 6. The robot was able to maneuver using the MATLAB GUI. The response time of transmission of input is to the vehicle is very less even at a distance of 10m which is appreciable in this case. The real-time video was captured in a separate GUI, input of which is given by the IP Camera.

This concept discussed in this paper can come very handy in places which are inaccessible to humans. This can be highly beneficial in compactly spaced areas, highly guarded places, places prone to fire and attacks. This system can provide valuable information which can save thousands of lives and property. The robot can identify the best possible route to reach a destination with the use of GPS navigation and mapping software and hence save time.

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