Automatic Car Control using Microcontroller and MATLAB

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Abstract

The goal of this project was to design and develop the control mechanism of a car using a microcontroller chip and MATLAB. With MATLAB mounted on the machine, the camera on the car will serve as an eye and the PIC microcontroller will power the motors. This autonomous car would have a mirror, a power supply for the microcontroller, and engines with wheels on it. The camera output is connected to the computer that performs the acts with the assistance of MATLAB. Image processing is performed by the MATLAB by observing a portion of the picture collected by the camera. Then this binary signal from MATLAB can now go to the microcontroller through serial communication with MAX232. Now, this signal is going to go to the microcontroller as a serial input, and the controller is designed as such to have any aspect of a specific output concerning serial port data. This output is related to l293d and also amplifies the signal and then links to the motors. The motors power the wheels, and it also helps to spin with the aid of another rotor. It should help the vehicle to work correctly.

I. Introduction

In the time of automation during which the initiative was limited to a certain number, several programs were introduced. This article proposes a data collecting system for manufacturing or climate monitoring that calculates such parameters as temperature, humidity, amount of airborne gases, the presence of any person close to the confined areas, and transmits these parameters through wireless communication to both the control room and to the person in charge. When a certain parameter is crossed, the person may send a command via the Smartphone to the control room [1]. Color is the most important function of the object identifying, sorting, detecting, and monitoring. The robot is normally installed with a monitor, or the monitor is placed in the workspace to detect the target. With a color recognition system, this technique can be used in material processing in the manufacturing and shipping sectors where items passing along a conveyor belt can be distinguished. The 'Objrec' algorithm is written in this paper in MATLAB for the process. To classify the target and send the correct commands to the microcontroller, the 'Objrec' algorithm is performed using serial communication for the robot to conduct the sorting operation [2]. This article seeks to demonstrate how the room heating system is configured and implemented, which maintains a preset temperature in the given room. Repeated ON / OFF, a long settling period, large time fluctuations, and over-shootings restrict the temperature regulation of the heating system. Proteus simulates the setup, and MATLAB simulates the control process. Throughway of experimental design, energy savings in comparison with conventional heaters was observed at 12.11%. [3]. This paper suggests a modern energy meter reading network connectivity framework by combining communication technologies and operating programs alongside the current meters. To provide direct control to the use of power, a wireless or wired contact device is combined with an automated energy meter. Since these are two separate units, the energy meter supplies the read information as to when the contact device needs them. Besides, the contact network is linked to the regional / sub-regional electricity center, which will serve as a base station instead. Instead of building a new network framework and backbone, it is often feasible to use some of the stably established network service infrastructures to reduce initial investments. The communication medium is specified according to the user number, and certain cryptographic standards are used to protect it. By checking the energy usage regularly, the base office must check the performance of energy meters. This will also avoid damage or malfunction of the power meter [4]. For people with walking disabilities, a means of locomotion is required. While crutches
may fix several of the issues, there are certain situations where crutches will not be able to address the issue entirely. The solution to that is the wheelchair. In today's period, the nature and motion of the wheelchairs have greatly changed with the progress of technology. This can be controlled today using microcontrollers that remove the need for human effort. However, the cost considerations are significant, as the use of these technologies can further raise equipment costs significantly. A low-cost, modified wheelchair model with a microcontroller is being developed in this study [5]. The class control mechanisms introduced up until now have proven effective in stopping class proxies but were not able to assess whether or not the class still functions within a given study time. Even the system's Proteus simulation model is built to test real-time running. To test the performance, the actual prototype is built and introduced at the UPES. Further, the downside of this method is that it is easy to capture the proxies. If the person with multiple cards enters the area, the machine can only transmit one person's data, but if he/she puncture several cards (placed within the area), it can easily be detected [6]. Building energy management systems play a major function in controlling the regulation and automation in buildings. These devices may play a significant role in routine energy control and management and thereby save the time and expense that is necessary. The focal point of the demand for building automation is based on improved consumer facilitation with lowered running costs in terms of comfort. Improving energy quality would, therefore, lead to saving the atmosphere. Thus laws and ranking schemes have been created that prescribe the energy management and control standards in a house. For instance, building services and machinery management and automation play a decisive role in gaining green construction rankings from recognized institutions. The system proposed is to control operational devices such as fire alarm and gaseous alarms as well as artificial lighting (on/off & dimming power). In the future, the original definition can all be incorporated into a shared system for the control and management of various equipment [7]. This book offers a simple device development framework for beginners to launch interface experiments with MATLAB® on Arduino. It addresses the programming fundamentals in 3 parts with main Features as Introduction of Arduino IDE viewers, Proteus simulation models, Arduino monitor interfaces, sensor interfaces (both optical and analog), actuators [8]. The Internet of Things and the creation of robots are emerging as a wide-ranging platform for monitoring and protecting various incidents with a range of devices, including fire fighting robotics, protection robotics. The article describes the built-in smart multi-sensor security robot with the IoT intimacy capabilities for detecting different parameters along with details on visual analysis. The computer will, therefore, monitor various parameters for the construction of multiple stories that will be handled through Atmega328 microcontrollers and ESP8266 with a thermal camera and autonomous board with additional circuits, for a visual interface. The cloud service is developed using ThingSpeak Software, and a robot movement system is programmed in Virtuino APP. The cloud server successfully demonstrates the output of sensors with robot location and power [9].

2. Serial Communication between PC and Controller

To send data via a single line through a bit stream is known as serial communication. Reception is of type SIPO-Serial Input Parallel Output. Transmission is of type PISO-Parallel Input Serial Output. The clock used in the serial interface is called BAUD RATE.
Use MAX232 the serial contact between PC and microcontroller takes place. PIC has two buffers that enable full-duplex communication. We have to re- the TXSTA registry to adjust settings. One of the two Serial I/O devices is the Common Synchronous Asynchronous Receiver Transmitter (USART) module. (USART is also known as the Serial Communications Interface or SCI) USART can be designed as a full-duplex asynchronous network capable of communicating with peripheral devices such as CRT terminals and personal computers or as a half-duplex synchronous network capable of communicating with peripheral devices such as A/D or D/A integrated circuits, cellular EEPROMs, etc.

**The USART can be configured in the following modes:**

- Asynchronous (full-duplex)
- Synchronous - Master (half-duplex)
- Synchronous - Slave (half-duplex)

Bit SPEN (RCSTA<7>) and bits TRISC<7:6> have to be set to configure pins RC6/TX/CK and RC7/RX/DT as the Universal Synchronous Asynchronous Receiver Transmitter.

**TXSTA: TRANSMIT STATUS AND CONTROL REGISTER (ADDRESS 98h)**

<table>
<thead>
<tr>
<th>R/W-0</th>
<th>R/W-0</th>
<th>R/W-0</th>
<th>R/W-0</th>
<th>U-0</th>
<th>R/W-0</th>
<th>R-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSRC</td>
<td>TX9</td>
<td>TXEN</td>
<td>SYNC</td>
<td></td>
<td>BRGH</td>
<td>TRMT</td>
</tr>
</tbody>
</table>

**bit 7 CSRC: Clock Source Select bit**

Asynchronous mode:

Don't care
Synchronous mode:
1 = Master mode (Clock generated internally from BRG)
0 = Slave mode (Clock from external source)

**bit 6**  
TX9: 9-bit Transmit Enable bit  
1 = Selects 9-bit transmission  
0 = Selects 8-bit transmission

**bit 5**  
TXEN: Transmit Enable bit  
1 = Transmit enabled  
0 = Transmit disabled  
Note: SREN/CREN overrides TXEN in SYNC mode.

**bit 4**  
SYNC: USART Mode Select bit  
1 = Synchronous mode  
0 = Asynchronous mode

**bit 3**  
Unimplemented: Read as '0'

**bit 2**  
BRGH: High Baud Rate Select bit  
Asynchronous mode:  
1 = High speed  
0 = Low speed  
Synchronous mode:  
Unused in this mode

**bit 1**  
TRMT: Transmit Shift Register Status bit  
1 = TSR empty  
0 = TSR full

**bit 0**  
TX9D: 9th bit of transmitting data. Can be a parity bit

Now in mikroC UART terminal also work as shown in Fig.2
Now coding

1). to transmit data..
   void main()
   {
     usart_init(2400);
     while(1)
     {
       usart_write('A');
       usart_write('M');
       usart_write('A');
       usart_write('N');
       delay_ms(600);
     }
   }
2). to transmit as well as read
   unsignedint i;
   void main()
   {
     usart_init(2400);
     while(1)
     {
       if(usart_data_ready() )
       {
         i= usart_read();
         usart_write(i);
       }
       usart_write('A');
       usart_write('M');
       usart_write('A');
       usart_write('N');
delay_ms(600);
}

Thus serial communication has been studied successfully

3. Methodology

35x771\}

Essential terms and types of Images

**Pixel:** Pixels are the elements of a picture and are the smallest possible element to be seen on our screen.

**Binary Image:** It is a picture of black and white pixels only.

**Grayscale Image:** This includes values of intensity from deep (which is absolute black) to average (which is perfect white) and different gray shades between them. Typically this scale ranges from 0 to 255.

* Note: What we refer to as black-and-white in the daily language (as in old photos) merely is grayscale. Hence prevent technological ambiguity here.

**Color Image:** We always noticed this! Such a picture consists of the three primary colors, Red, Green, and Blue, and is thus often called an RGB image.
4. Practical Demonstration
A car is an automobile which traces a path and travel along with it. A conventional car has a driver riding it over the journey. Here the concept is like if we control the way or the color of the path throughout, then we need not have drivers in our cars. The camera installed in the system is used as an eye which performs the function of the driver. The output of the camera has been in the form of the binary image is sent to the system through a cable. The binary image is then uplifted by the MATLAB installed in the system. Only a part of the whole picture is being studied by the MATLAB, which is most probably the middle part of the image. Now MATLAB will decide the maximum color present on the image obtained. This is done by a program written below this paragraph. By the use of the following program, we get some individual results.

Program used in MATLAB
```matlab
clear all;
clc;
vid = videoinput('winvideo', 1);
set (vid, 'ReturnedColorSpace', 'RGB');
ing = getsnapshot(vid);
imshow(img);
s = serial('COM101');
fopen(s);
r = img(:,:,1)
g = img(:,:,2);
b = img(:,:,3);
szr = size(r)
szg = size(g)
szb = size(b)
for i=220:260
    for j=300:340
        if r(i,j)> 150
            red = r(i,j);
fwrite(s, 0);
        end
    end
end
for i=220:260
    for j=300:340
        if g(i,j)> 150
            green = g(i,j);
fwrite(s, 1);
        end
    end
end
```
This program provides us with a signal which can be sent through serial communication to microcontroller. This signal generated through MATLAB will now send to MAX232 from the computer by USB to serial cable. Now this signal from MAX232 will go to the serial com port in PIC16f73, which is there for serial communication. This incoming signal will then be received in the microcontroller and then the respective decisions on the microcontroller are being taken by the controller by the use of this program which is burnt on it.

**Program burnt in pic microcontroller**

```c
void main()
{
    unsigned char i;
    TRISB=0;
    PORTB=0;
    Usart_Init(9600);
    while(1)
    {
        if(Usart_Data_Ready())
        {
            i=Usart_Read();
            if(i==0) //RED
            {
                PORTB.F7=0;
                PORTB.F6=1;
                PORTB.F5=0;
                PORTB.F4=1;
            }
            else if(i==1) //GREEN
            {
                PORTB.F7=0;
                PORTB.F6=0;
                PORTB.F5=0;
                PORTB.F4=1;
            }
            else if(i==2) //BLUE
            {
                PORTB.F7=0;
                PORTB.F6=1;
                PORTB.F5=0;
                PORTB.F4=0;
            }
        }
    }
}
```
This program helps in providing an output signal from the controller. These signals are like for being red on camera there is 0 on serial communication and for this both output at port b is given power. Same for being blue on camera there is 1 on serial communication and for this one of the output at port b gets power. Same in case for being green on camera there is 2 on serial communication and for this other of the output at port b gets power. Now with port b we have connected the l293 which is used to amplify the signal. This l293d is further connected to the motors RC500-FN/22185DV SMB P041115 ROHS. These motors are further connected to the wheels and thus form a car. Now whenever the camera sees an image and then MATLAB process it and controller interpret a signal and thus provide signal to a particular motor and thus the wheels are driven.

5. FUTURE SCOPE
These kinds of vehicles can be a boom shortly. Taken if in a plant where there are various loading and unloading all the times. So, if by a centralized system, if we can control the color of the tracks, then all the vehicles will drive themselves and no need for particular drivers. Also, in the case of all public transport, if Govt. can control the color of roads, then they can ride their vehicles throughout without drivers. This leads to less human effort and more efficiency.

Reference