INDUSTRIAL INTELLIGENT LINE FOLLOWER ROBOT WITH AUTO GO DOWN DETECTION, AUTO OBSTACLES DETECTION, WIRELESS VEHICLE STATUS DATA TRANSFER TO SERVER AND MANY MORE FEATURES

INTRODUCTION:

This project is based on VTU syllabus. The proposed system is based on ATMEL 89S52 µcontroller which is in our syllabus.

For doing this project we use some of the software like

- Embedded C for programming the application software to the microcontroller.
- Protel schematic software is used for designing the circuit diagram for this project.
- Express PCB software is used for designing the PCB for this project.

(Since PCB making is a big process and involves lot of machineries which are expensive, we are going to outsource this to the manufacturer.)

ABSTRACT:

The present condition in Industry is that they are using the crane system to carry the parcels from one place to another, including harbor’s. Some times the lifting of big weights may cause the breakage of lifting materials and will cause damage to the parcels too.

Application of the proposed system is for industries. The robot movement depends on the track. Use of this robot is to transport the materials from one place to another place in the industry. IR transmitter and receiver are used to find the obstacles in the path. RF transmitter and receiver are used to send/receive the command from/to robot/control unit. The IR and RF technology is one of the most widely used wireless communication technique in most of the embedded applications. For RF communication we are using the transmitter and receiver in the range of 433 MHz. for IR transmissions the IR led is used in the frequency of 38 kHz.

Components

- Power Supply : 5V/12V DC
- Micro controller : Atmel AT89S52
- LCD : 16x2 characters
- Proximity metal sensor.
- DC motors(12V DC)
- DC motor driver (L293D)
IR transmitter and IR receiver.

RF transmitter and RF receiver

Memory(24C04)

RF card & RF reader

Switches

Siren

SOFTWARE USED:

- Embedded C
- VB

WORKING PRINCIPLE:

This project is used to transport the materials from one place to another place in industries.

This robot vehicle has the facility to find out its path. The path is tracking by proximity sensor. First, RF card number (Location) has to be loaded into the memory, this is done by using switch1 and switch2 is used for storing corresponding number. After pressing the Start switch (switch3), according to sensor output signal the microcontroller controls the vehicle by using (forward/reverse/stop) the left and right side of the DC motor which are placed in vehicle. IR transmitter and receiver are used to find the obstacles in the path. The IR led will be switched on/off at a frequency and is received by the IR receiver. If any obstacle is placed in the path The IR sensor fails to receive the light rays, this time it gives a signal to the microcontroller that an obstacle is present in the path. The microcontroller will stop the vehicle immediately and siren will ON. After 1 minute the robot will check the path status. If obstacle is removed the robot will move forward. Else robot will send message to control room. After 5 minutes the robot will check the path status. Still obstacle is not cleared the robot will turn in the opposite direction and it will travel to starting place.

From the control office we can control the robots by sending commands from PC, this commands is encoded and sent through RF medium, the RF receiver in the vehicle will receive the commands and send to the microcontroller. The microcontroller will convert the decoded data and do the corresponding action. the RF encoder (12 E)and RF decoder (12 D), which consists of 12 address bits and 4 data bits, so software written inside both the microcontroller will convert the user data into 4 bit encoding form. The transmission is done under the frequency of 433 MHz.
COMPONENTS DESCRIPTION:

Power supply:
The microcontroller and other devices get power supply from AC to Dc adapter through 7805, 5 volts regulator. The adapter output voltage will be 12V DC non regulated. The 7805/7812 voltage regulators are used to convert 12 V to 5V/12V DC.

**Vital role of 7805 voltage regulator in ‘line follower robot’**

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**Micro controller-AT89S52**

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.

**Features:**
- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Full Duplex UART Serial Channel
- Fully Static Operation: 0 Hz to 33 MHz

**Vital role of Micro controller-AT89S52 in this project ‘line follower robot’**

The robot is controlled by microcontroller. It performs change the motor direction by giving signal to driver IC, getting command from switches, sending command to RF transmitter and transmit and receive the IR signal from IR remote.

LCD is connected to microcontroller as 4 bit data mode, before displaying anything in LCD Initialization have to do, so microcontroller will control the LCD initialization and select the data register and command register according to the purpose.
Buzzer is controlled by the microcontroller using single pins, i.e. giving high means device will switch on and vice versa. Sometimes it may be interchangeable according to the transistor used to drive the device.

**LCD (LIQUID CRYSTAL DISPLAY)**

LCDs can add a lot to your application in terms of providing an useful interface for the user, debugging an application or just giving it a "professional" look. The most common type of LCD controller is the Hitachi 44780 which provides a relatively simple interface between a processor and an LCD. Using this interface is often not attempted by inexperienced designers and programmers because it is difficult to find good documentation on the interface, initializing the interface can be a problem and the displays themselves are expensive.

**Vital role of LCD in ‘line follower robot’**

LCD is connected to microcontroller as 4 pins for data and a single pin for register select and enable.

LCD initialization is done by microcontroller, before initialization the LCD have to wait for 30 ms delay.

The application of LCD in this project is used to display the status of vehicles, then if any obstacle is present it will display the obstacles present etc.

**RF Encoder (HT 12E)**

The 212 encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the 212 series of encoders. The HT12A additionally provides a 38 kHz carrier for infrared systems.

**Features**

- Operating voltage 2.4V~12V for the HT12E
- Low power and high noise immunity CMOS technology
- Low standby current: 0.1_A (typ.) at VDD=5V
- HT12A with a 38 kHz carrier for infrared transmission medium
- Minimum transmission word: four words for the HT12E
- Data code has positive polarity
- Minimal external components
- HT12E: 18-pin DIP/20-pin SOP package
**Vital role of RF Encoder (HT 12E) in this project ‘line follower robot’**

RF encoder used is 12 E which has an automatic tuning facility to the receiver, it consist of 12 address bits and 4 data bits. In this project it is used to send the commands from vehicle to the control unit and vice versa.

**Applications**
- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

**RF Decoder (HT 12D)**

The 2<sup>12</sup> decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek 2<sup>12</sup> series of encoders (refer to the encoder/decoder cross reference table). For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen.

The decoders receive serial addresses and data from a programmed 2 12 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission.

**Features**
- Operating voltage: 2.4V~12V
- Low standby current
- Capable of decoding 12 bits of information
- Pair with Holtek's 2 12 series of encoders
- Binary address setting
- HT12D: 8 address bits and 4 data
- Built-in oscillator needs only 5%
- Valid transmission indicator
- Easy interface with an RF or a transmission medium
Vital role of RF Decoder (HT 12D) in this project ‘line follower robot’

The Decoder used is HT 12D which receive serial addresses and data from a programmed 2 12 series of encoders that are transmitted by a carrier using an RF transmission medium. This device is used to decode the encoded data. The output is 4bit form. This output is send to the microcontroller for further operation.

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- other remote control systems

RF transmitter

General Description

The MICRF102 is a single chip Transmitter IC for remote wireless applications. The device employs Micrel's latest QwikRadio™ technology. This device is a true "data-in, antenna-out" monolithic device. All antenna tuning is accomplished automatically within the IC which eliminates manual tuning, and reduces production costs. The result is a highly reliable yet extremely low cost solution for high volume wireless applications. Because the MICRF102 is a true single-chip radio transmitter, it is easy to apply, minimizing design and production costs, and improving time to market.

Features

- Complete UHF transmitter on
- Frequency range 300MHz
- Data rates to 20kbps
- Automatic antenna alignment,
- Low standby current <10A
Vital role of RF transmitter in this project ‘line follower robot’

In this project if vehicle had find a obstacles in his path it will send data to the control unit, and some times the control, unit will send command to the vehicle to change the path, this commands are send and received through RF frequency, the commands is converted into 4 bit encoded data format using encoder chip. The encoded data is transmitted by using this device. The transmission frequency range is 300MHz in the data rate of 20Kbps.

Applications

- Remote Keyless Entry Systems
- Remote Fan/Light Control
- Garage Door Opener Transmitters
- Remote Sensor Data Links

RF receiver

General Description

The MICRF002, an enhanced version of the MICRF001 and MICRF011, is a single chip OOK (ON-OFF Keyed) Receiver IC for remote wireless applications, employing Micrel's latest QwikRadio™ technology. This device is a true “antenna-in, data-out” monolithic device. All RF and IF tuning is accomplished automatically within the IC, which eliminates manual tuning and reduces production costs. Receiver functions are completely integrated. The result is a highly reliable yet extremely low cost solution for high volume wireless applications. Because the MICRF002 is a true single-chip radio receiver, it is extremely easy to apply, minimizing.

Features

- Complete UHF receiver on a monolithic chip
- Frequency range 300 to 440 MHz
- Typical range over 200 meters with monopole antenna
- Data rates to 2.5kbps (SWP), 10kbps (FIXED)
- Automatic tuning, no manual adjustment
- No Filters or Inductors required
- Low Operating Supply Current—240 μA at 315MHz (10:1 Duty Cycle)
- Very low RF re-radiation at the antenna
- CMOS logic interface to standard decoder and microprocessor ICs

Vital role of RF receiver in this project ‘line follower robot’

In this project the communication between vehicle and control unit is through RF frequency the RF encoder will encode the data sent by the microcontroller into 4 bit mode then it
is transmitted using the RF transmitter with frequency 433 MHz. The transmitted data transmitting from RF transmitter is received by RF receiver. The output of this unit is encoded data format. For decoding purpose this data is send to the input of decoder.

**Applications**

Automotive Remote Keyless Entry  
Long Range RFID  
Remote Fan/Light Control  
Garage Door/Gate Openers

**Siren:**

The siren subsystem produces an audible tone when powered. The siren will sound when the signal coming into the driver is high. It must be connected to a transistor, Darlington or transducer driver subsystem.

The siren is connected between the supply rail (+V) and the input signal. This acts as load on the driver. When the input signal coming into the siren subsystem is low, a potential difference across the siren causes current to flow. It is this flow of current that causes the siren to sound.

**Vital role of Siren in this project ‘line follower robot’**

This device will indicate the abnormal status of the robot. If robot found any obstacles in front of the robot immediately the siren will on. So the employees those who are in some other places can come and remove the obstacles.

**IR transmitter**

This IR led is used to emit the infrared rays at particular frequency. The emitting light is not visible in human eyes. In the transmitting side led will glow in a particular frequency.

**Vital role of IR transmitter in ‘line follower robot’**

The IR Transmitter is used is in the project to find out the obstacles in the vehicle path, the transmitter will generating the IR rays at a particular frequency,these frequency is received by the IR receiver .if any obstacles is present the receiver will fail to receive the IR rays.

**IR Receiver**

The IR receiver is a three pin module which will receive the IR rays and decode the signal into data.
Vital role of IR Receiver in this project 'line follower robot'
This will receive the control signal which are transmitted from IR remote / IR transmitter and gives the output to the input of microcontroller.

Proximity metal sensor
This sensor is used to detect the metal part. If it detects the metal part, immediately it will give the output to output terminal.

Vital role of Proximity metal sensor in this project ‘line follower robot’
This is used to detect the path. Depending upon its output the microcontroller will control the motors.

APPLICATIONS OF THIS PROJECT:
- Industries
- Automation.

FUTURE ENHANCEMENT:
In future we can add control the speed of the device according to the command sent by the control unit.