Ahsanullah University of Science & Technology

Department of Computer Science & Engineering

[Multipurpose LFR]

Course No. : CSE 3216
Course Title : Microcontroller Based System Design Lab

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Submitted By

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Section	: A2

Introduction:

A line follower robot(LFR) is basically a robot, designed to follow a path determined by the user. Line follower robot actually senses the line and run over it. It mainly follows a black line on white surface or a white line on black surface. This is done by infrared sensors. Sometimes, a lfr can also detect obstacles using ultrasonic sensor.

Objectives:

The objectives of our project is to build a LFR which is capable of following a path and according to the keypad input, it stops at many points after going a certain amount of distance and fetch goods from that point. It also detects the obstacle while going through its path.

Equipment:

- **Hardware Components:**
  - Laptop
  - Arduino Mega
  - Motor Driver Shield
  - TT Gear Motors (4X)
  - Wheels (4X)
  - Infrared Sensors (2X)
  - Ultrasonic Sensor
  - 4*4 Keypad
  - Jumper Wires
  - Battery
  - Battery Holder
  - Chassis

- **Software Components:**
  - Windows OS
  - Arduino IDE
  - Proteus

- **Others:**
  - White sheet having black lines
  - Tray

Description of Equipment:

Arduino: We've used arduino mega 2560 in our project. The Arduino Mega is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), 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 battery to get started.

Motor Driver Shield: Robot needs a driver IC for controlling and giving power to the motors. The microcontroller sends a signal to the driver which acts as a switch. The microcontroller only sends a signal to the switch and then the switch must give required voltage to the motors. If the received signal by the driver is high, it will rotate the motors.
A good motor driver is IC L298 which has been used to control four motors. It is an integrated monolithic circuit in 15-lead Multiwatt and Power SO20 packages. It is a high-voltage, high-current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC, and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. L298 has 2 amperes per channel current capacity and it can support up to 45 volts for outputting. Moreover, L298 works happily up to 16 volts.

TT Gear Motors & Wheels : We've used four tt gear motors and wheels. The movement system is an important part of a robot and its objective is how to move the robot from one point to another point.

Chassis: The chassis is used for the construction of the body. Two chassis have been used, connecting with many nuts and bolts.

Infrared Sensors: An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the black line on white surface. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the line, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.
We've used two IR sensors in our project.

Ultrasonic Sensor: Ultrasonic sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is used for measuring distance or sensing objects. The module has two eyes like projects in the front which forms the ultrasonic transmitter and receiver. The ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the ultrasonic receiver module.

Keypad: While a key is pressed through the keypad, the lfr stops at different points after going a certain amount of distance according to the keypad input. Then fetch some goods from that point.
We've used 4*4 keypad for implementing the feature.

Wire: Male-male, male-female and female-female wires have been used for connecting the equipment with each other.

Battery: Battery is used for the power supply.

Impact on Society:

- **For Physically Disabled Person:** Our system can be very useful for the physically disabled persons as the lfr can stop at a certain distance. If a physically disabled person stands a point, the lfr can go to him, carrying the goods he/she needs.
- **In Restaurant:** This system can be implemented in restaurants for carrying goods on it and delivered the goods to many points where the tables are placed.
- **In Hospital:** The lfr can be used in cabins which are placed in a line.
- **In Industry:** In an industry, the lfr can also be used.

Future Implementation:

At present, our lfr is able to follow a black single straight line. In future, we want to make this capable of taking various degrees of turns. And according to the keypad input, the lfr will decide which angle of path it should move.
While running, if it detects any obstacle, it will stop and wait for a few moments to get an obstacle free path. And if that doesn't happen, the lfr will come back to the starting point. We also want to implement this system on a black surface and white lines.

Procedure:

Our **'Multipurpose LFR'** follows a black straight line on a white surface. According to the keypad input, it stops after going a certain amount of distance. Suppose, if 1 is pressed through the keypad, it goes about 20 centimetres distance and then stops. If 2 is pressed, it goes about 40 centimetres and stops.

It stops at many points to deliver many lightweight goods or take goods from those points. While going through the path the lfr stops if it detects any kind of obstacles.

Problems Faced:

- Sometimes, ir sensor read wrong values.
- Motor driver shield needed more power to put more force to turn.
- Motor driver shield's inputs were not working. So, we had to use arduino mega for alternative inputs.

Budget:

Equipment	Quantity	Amount(TK)
Arduino Mega	1	1200
L293D Motor Driver Shield	1	500
Infrared Sensor	2	200
Ultrasonic sensor	1	150
TT Gear Motor	4	200
Wheel	4	80
9 Volt Battery	1	100
4*4 Keypad	1	100

Male-male,female-female, male-female wire bundle	3	300
Chassis	2	100
Battery Holder	1	50
Sheet	1	50
Tape	1	50
Glue	3	60
Total		**3140/-**

Contribution:

Arnab Saha (16.02.04.036)

- Physical structure implementation
- Circuit implementation
- Keypad's coding
- Report writing
- Buying components

Noor Islam Sunny (16.02.04.038)

- Physical structure implementation
- Circuit implementation
- Slide preparing
- Buying components

Saffat Rafiq Raaz (16.02.04.041)

- Proteus design

- Circuit design
- Motor and IR sensor's coding
- Testing
- Report writing
- Buying components

Fakhrul Islam Fahad (16.02.04.051)

- Physical structure implementation
- Circuit implementation
- Ultrasonic sensor's coding
- Slide preparing
- Buying component

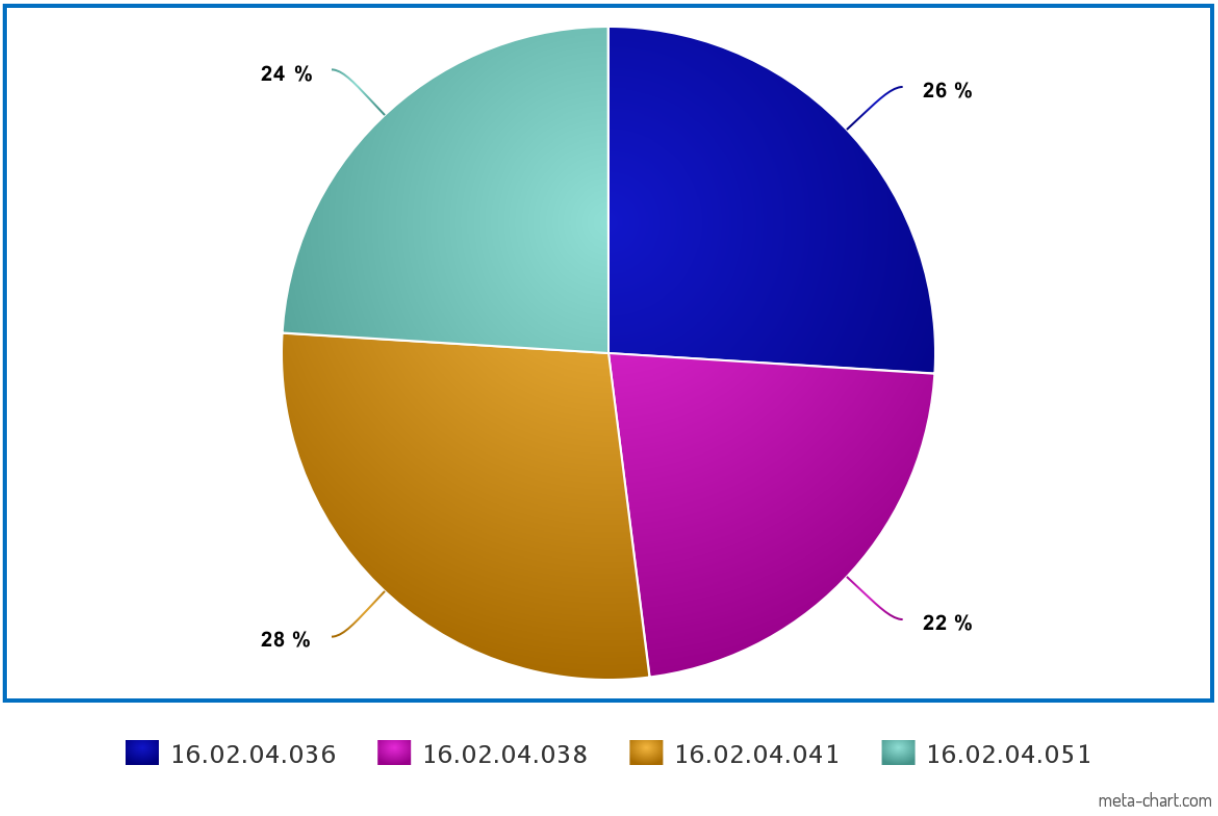

Figure 1: Contribution Chart.

Design:

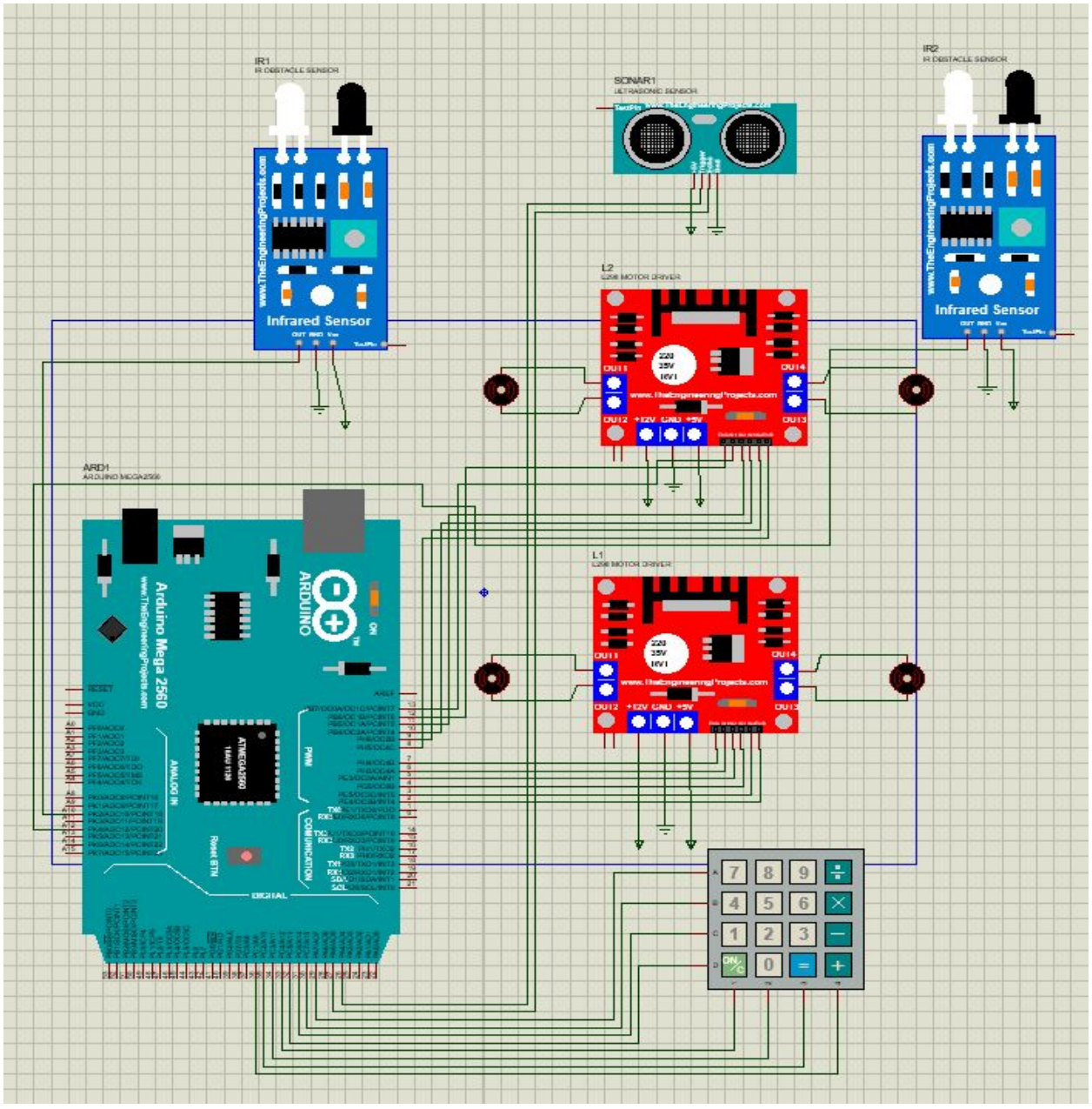

Figure 2: Proteus Design.

Some Images of the Project:

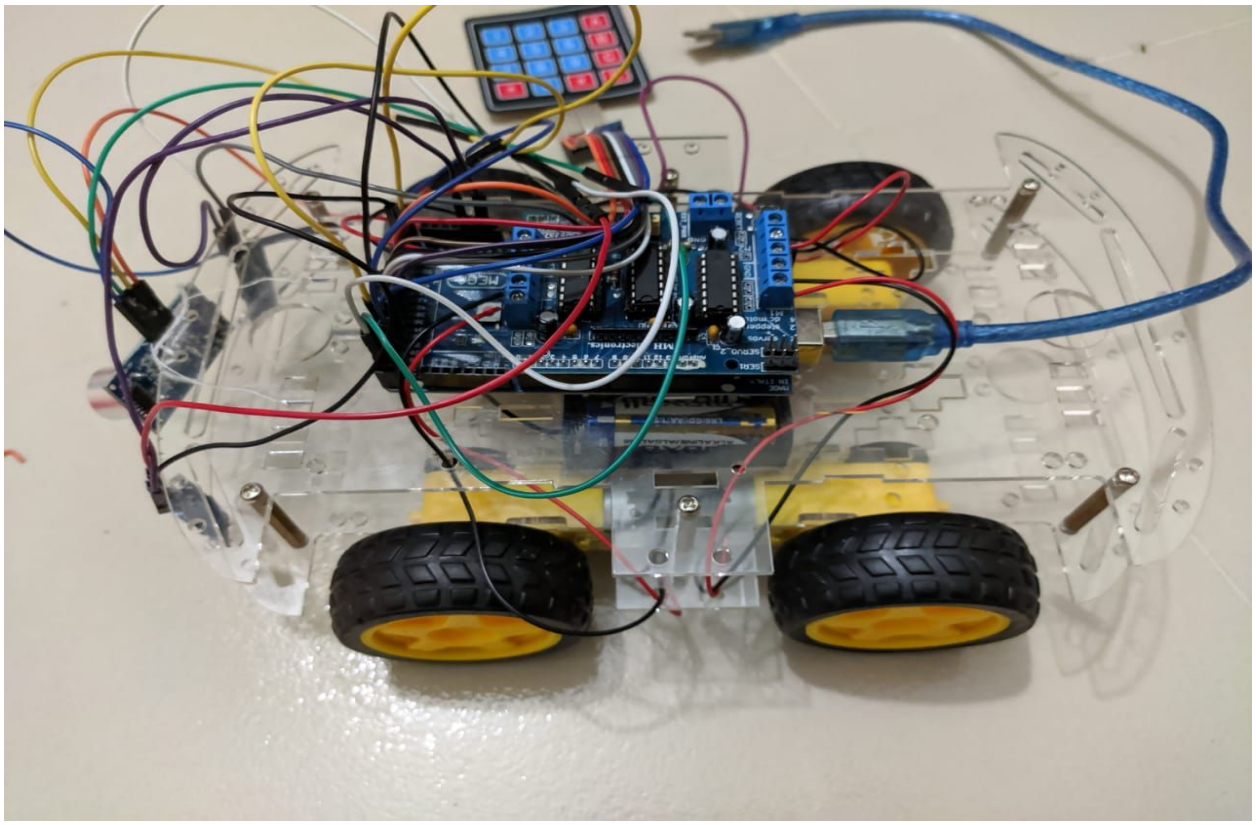

Figure 3: Top View.

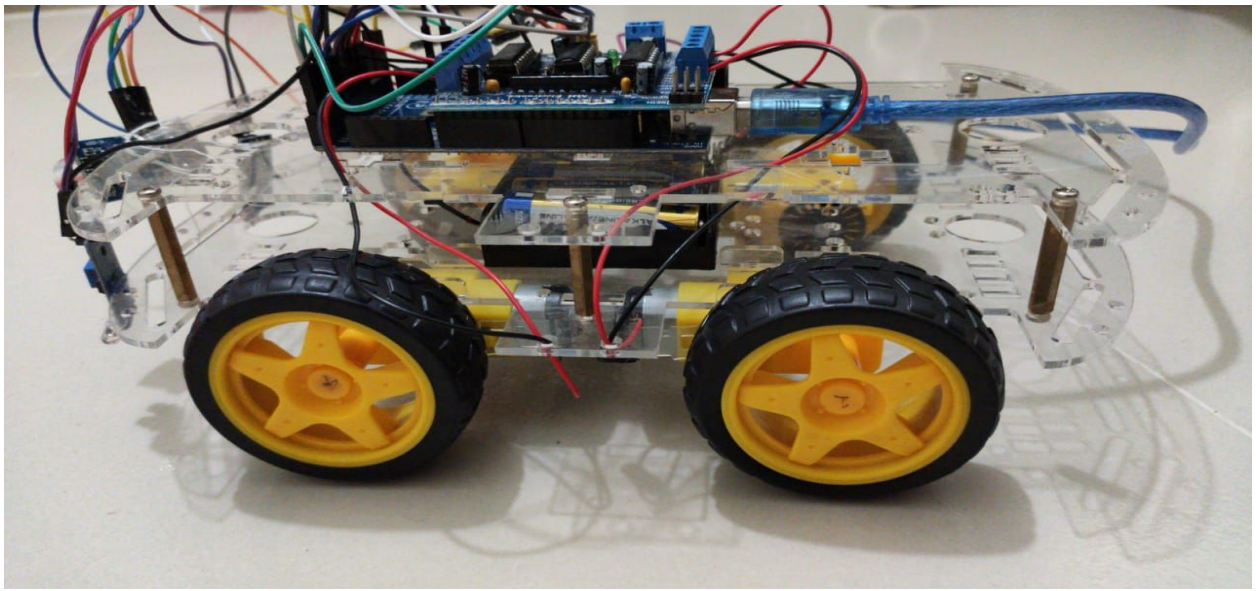

Figure 4: Side View.

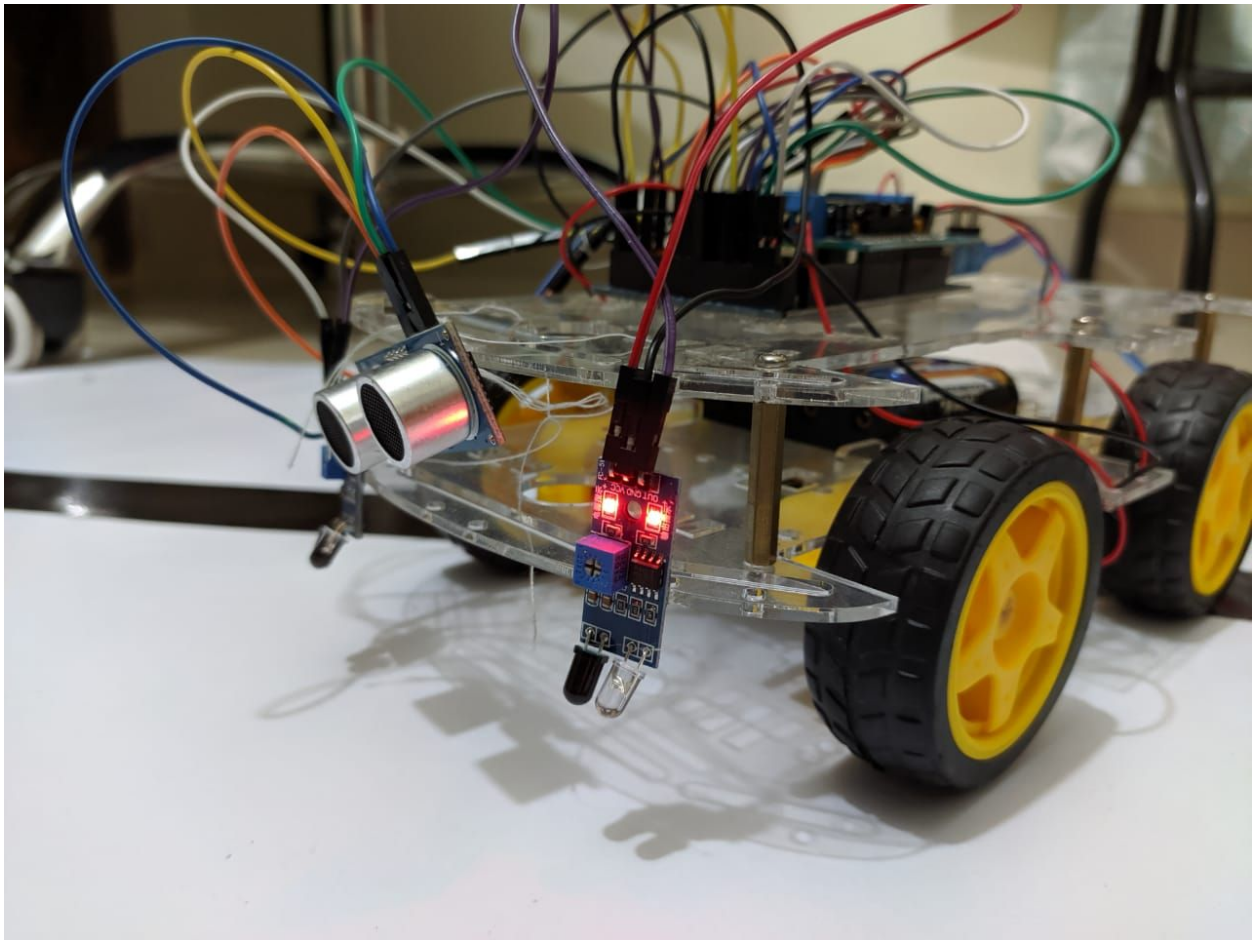

Figure 5: Front View.

Conclusion:

The line follower robot, we are introducing can be used for multipurpose deeds. In a very small budget, this lfr can be built. The features of this lfr are very useful for the society. These can reduce the work loads for the people/organization. So, we can say that our project, **'Multipurpose LFR'** can put a good impact on the society.