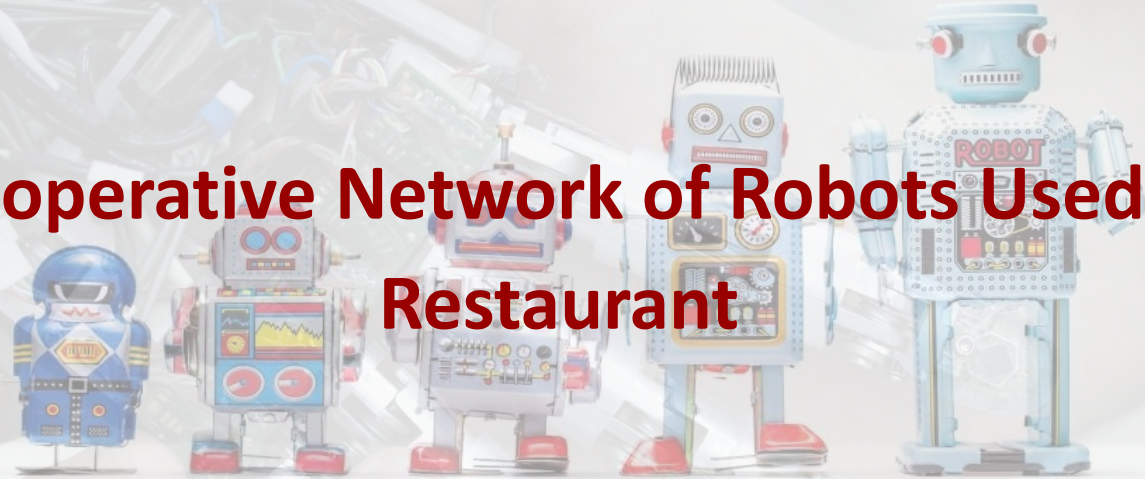
Co-operative Network of Robots Used in Restaurant



Prepared by :

- *Essam Mohamed*
- *Abdullah Hassan*
- *Khaled Magdy*
- *Ahmed Samir*

Supervised by :

- *Assoc.Prof. Emad El-Samahy*
- *Dr. Mohamed Helmy*

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Introduction:

- Networked Robots refers to multiple robots operating together in coordination or cooperatively with sensors, embedded computers, and human users. Cooperation entails more than one entity working toward a common goal while coordination implies a relationship between entities that ensures efficiency or harmony.
- Robots are functioning in environments while performing tasks that require them to coordinate with other robots, cooperate with humans, and act on information derived from multiple sensors.

Introduction (cont.):

Co-operative network, due to this technology we now can make the robots communicate to each other without any need for human action by using “The Co-operative Network” but humans can observing or emergency interfere.

Overview Purpose:

We built a system to control in co-operative network consists of multi robots, this robots can serve in several fields as medical, restaurants and others.

Motivations & Objectives:

Our goal is to transform people's effort to automated work, and use the Co-operative network between robots. This is the main goal of how the robots will communicate with each other at a closed place, in order to achieve efficient tasks that in the other way can be very complex and time consuming or too costly.

Problem Statement:

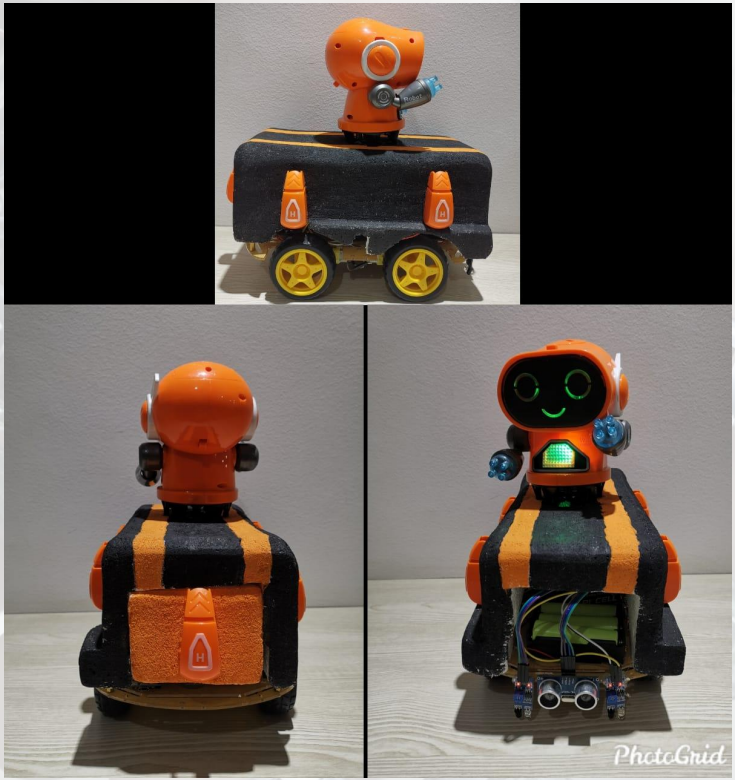
- Our project could be suitable with many industries and companies like hospitals, laboratories, restaurants and other places. we will simulate our project on a restaurant.

- The main problem that how will the robots work together without failures and how to avoid the problems which can affect on the system through cooperative network.

Proposed Model:

- We used two robots to simulate our cooperative network and we designed a “maket” contains the track that the robots will follow and the tables of the restaurants that will be served from the robots. We used a Node MCU Chip to act as a server to handling the requests and the communication between the robots
- If a guest request a robot for some purpose the guest will send this request by pushing the button which placed on this table, then the server will receive the request and send to the robot order to go to this table and serve the guest.

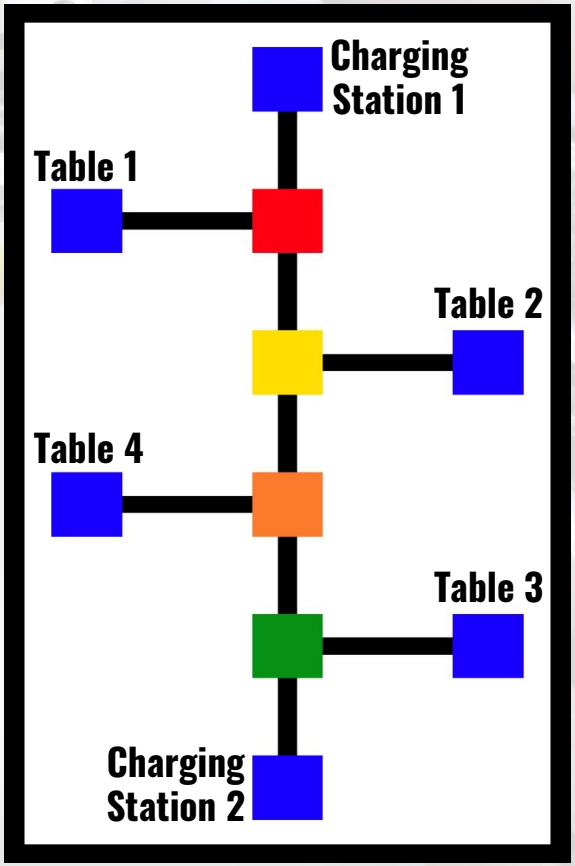
Our Robot



Scenario:

1. The guest sits on a table.
2. Pushing a button to request a robot.
3. Server receives the request.
4. Server assigns a robot to go to the table.
5. The assigned robot is going to serve the guest.
6. The robot goes back to the charging station until finishing the order in the kitchen.
7. After finishing the order, the robot comes back to the kitchen and takes the order and delivers it to the guest.
8. The robot goes back to the charging station.

Design of Restaurant Tracks:



This is a simple design to simulate a restaurant consisting of 4 tables and 2 charging stations by the BLUE color and the other colors to make decisions like TurnRight() or TurnLeft() and the black lines to redirect the robot to its right route.

Video:

Hardware tools:

- Arduino UNO
- Cars with 4 wheels and 4 motors
- H-Bridge
- IR-Sensor
- Ultrasonic Sensor
- Buzzer
- Lithium Batteries
- Jumper Wires
- Push Buttons
- 10mm Led Lights
- Resistors
- Nodemcu 0.9 as a Slave
- Nodemcu 1.0 as a Master
- MPU6050 Sensor (Accelerometer)
- TCS34725 Color Sensor
- Line Follower

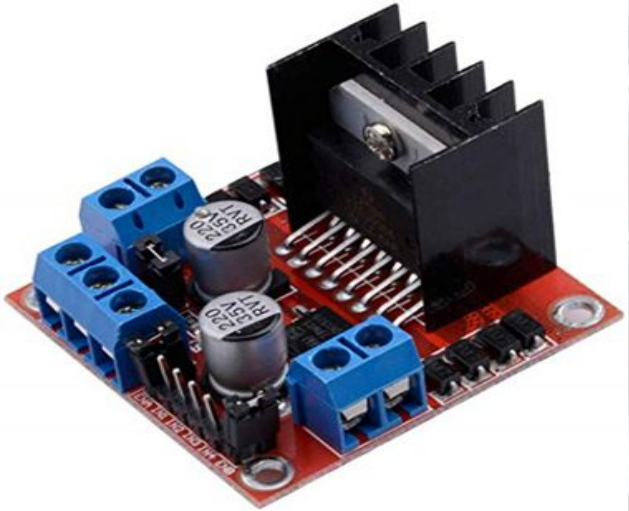
Arduino UNO

Arduino is an Microcontroller open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it

Car with 4 wheels

- The car represents the robot
- Car with 4 wheels, 1 wood plate and 4 motors.

H-Bridge



- For each two motors, you should have 2 pins to control the output.
- If you pull one pin HIGH and the other one LOW the motor should spin in a direction.
- If you invert this configuration, the motor will spin in the other direction.
- Pulling both pins to LOW or both to HIGH will stop the motor.

IR-Sensor

- An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings.
- An IR sensor can measure the heat of an object as well as detects the motion.

Ultrasonic

- An ultrasonic sensor is a speaker or microphone that emits and receives ultrasound.
- There is also a type that can handle both emission and reception. Vehicle parking sensors are equipped with this type of sensor.

Buzzer

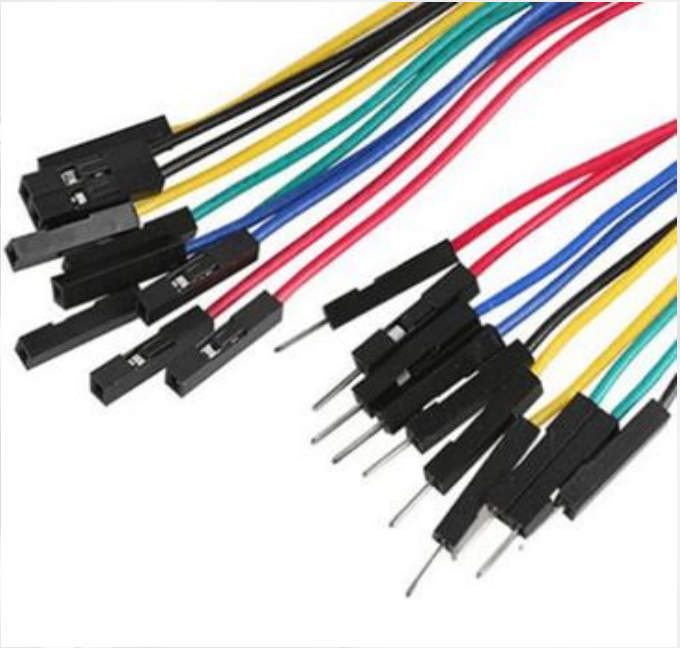
A buzzer is generally used to signal user in the form of tone or beep. This type of buzzer widely used in alarm.

Lithium Batteries

We used lithium batteries and 9V batteries as a power supply for the arduino board and all components and sensors that we used.

Jumper Cables

- Jumper cables, are a pair of insulated wires of sufficient capacity with alligator clips at each end to interconnect the disabled equipment/vehicle with an auxiliary source.
- There are three types of it:
  - Male-To-Male
  - Female-To-Female
  - Male-To-Female



Push Buttons

A push-button (also spelled pushbutton) or simply button is a simple switch mechanism to control some aspect of a machine or a process.

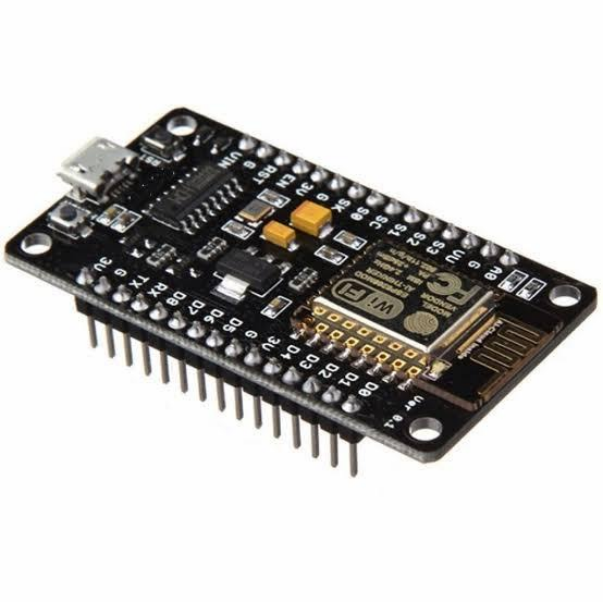
10mm Led Lights

LEDs are available in a variety of sizes and shapes. We carry a wide assortment of the most common models of 3mm, 5mm, 8mm, and 10mm LEDs.

Resistors

Resistor is an electrical component that reduces the electric current. The resistor's ability to reduce the current is called resistance and is measured in units of ohms (symbol: Ω).

NodeMCU 0.9 (ESP-12 module)

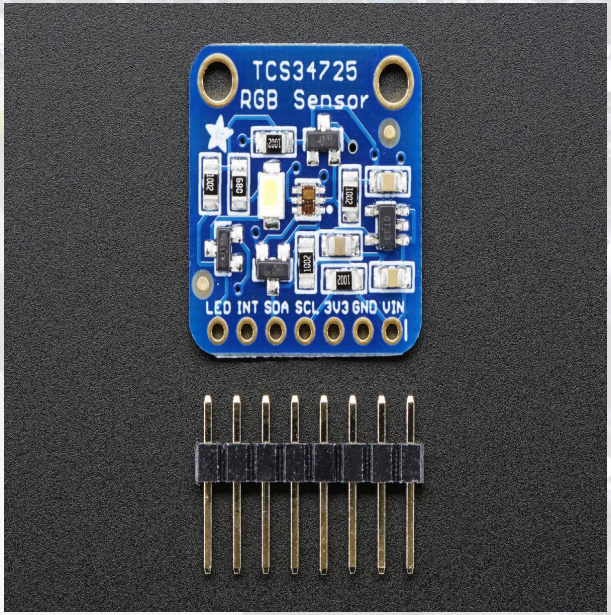


- NodeMCU is an open source development board and firmware based on the widely used ESP8266-12E WiFi module.
- We used it as a master (server) to allow the robots to connect to it and this master recive the requests form the tables then assigned the robots for serving.

NodeMCU 1.0 (ESP-12 module)

This is another version of NodeMCU Chip, We used it as a (slave) on each robot to be able to connect by WiFi on a network to communicate with the other robots.

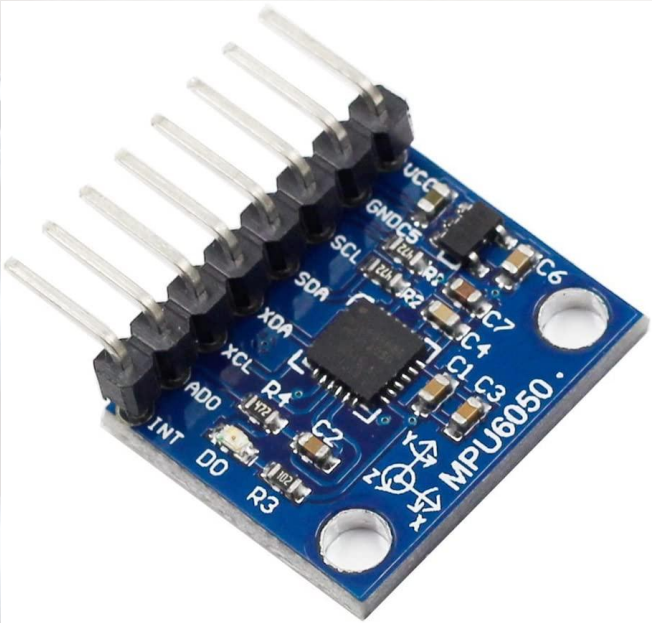
TCS34725 Sensor



The TCS34725 device provides a digital return of red, green, blue (RGB), and clear light sensing values. We used it for color detection.

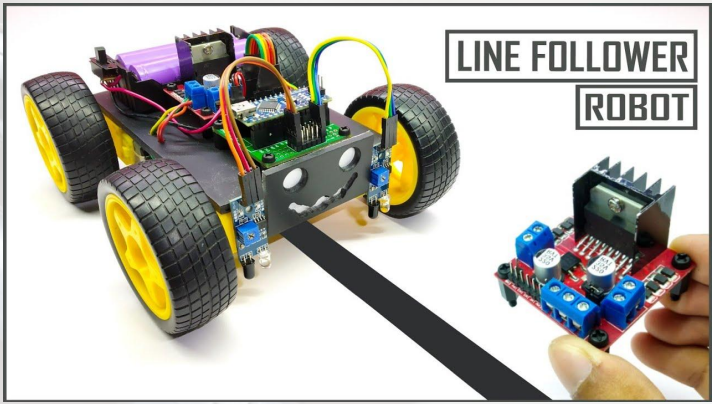
MPU6050 Sensor (Accelerometer)

The MPU6050 IMU has both a 3-Axis accelerometer and 3-Axis gyroscope integrated on a single chip. The gyroscope measures rotational velocity or rate of change of the angular position over time, along the X, Y and Z axis.



Line Follower

The robot provided with two infrared proximity sensors to detect the line and on the basis of input received from the sensors, the Arduino will direct the motors to move.

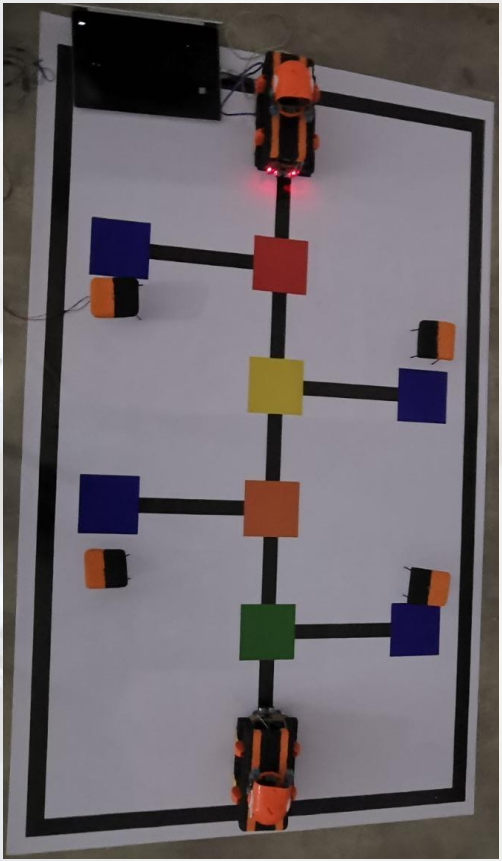


Software tools:

We used embedded C language for programming the Arduino uno, we control our hardware components with this language as IR-Sensor, Ultrasonic Sensor, RGB sensor, Buzzer, accelerometer and NodeMCU.

Communication between robots:

We used the NodeMCU 1.0 board in each robot to connect via the WiFi signal on the server which is NodeMCU 0.9 but acting as an access point to send instructions for each robot and this is an intranet network and the code written by the embedded C language.



Advantages:

Why would the project be wanted ?

- Reducing the cost.
- Reducing service time.
- Giving High quality of service.
- Easy to use.

Disadvantages:

- In some cases, The robot goes out of its track
- The robot serve specific tables
- Robot doesn’t work perfectly with batteries instead of USB cables

Conclusion:

- In conclusion, We built a cooperative network between robots to reduce costs and time consmution. And we used some hardware tools and components to build our robots simulated in cars.
- We built the co-operative network between robots using the server that controlled the robots and the table requests.
- We used embedded C language to:
  1. Write codes
  2. Upload codes on the used chips
  3. Connect the robots to the server
  4. Create the communication of the system through the WiFi signal within intranet network.

Future Works:

- In the future, We can improves the accuracy and provides the robots with camera and start writing AI programs to allow the robot to do some analysis and be more active with the users for example analyse the face feedback of them.
- And we can add speakers and mic devices to talk with guest and take the order from them by voice instead of the touch screen or both together.
- Then we can let all the restaurant processes to done with robots to do all stuff in the restaurant like cooking the food, take the payment from the guests and make statistics and analysis.
- We'll make communication control that will control large number of robots with a security model to prevent any intruder.

Other Co-operative Network Application

Labs

The cooperative network between robots can be applied at laps. we can use the robot to act as a person to finish your desired process to avoid crowding in the lap and if one patient has a contagious disease don't infect other people.

Scenario :

1. The patient sits at a waiting area.
2. A robot comes automatic because there is a sensor embedded in the chair or the seats.
3. Take the needed order from the patient.
4. Communicate with the server to complete the process.
5. Then going back to its charging station

Other Co-operative Network Application

Hospitals

The cooperative network between robots can be applied at hospitals. We can use the robot to act as a nurse or a person just delivering some samples, results of analysis and rays.

Scenario :

1. The patient sits at a waiting area.
2. A robot comes automatic because there is a sensor embedded at the chair or the seats.
3. Take the needed order from the patient.
4. Communicate with the server to complete the process.
5. Then going back to its charging station

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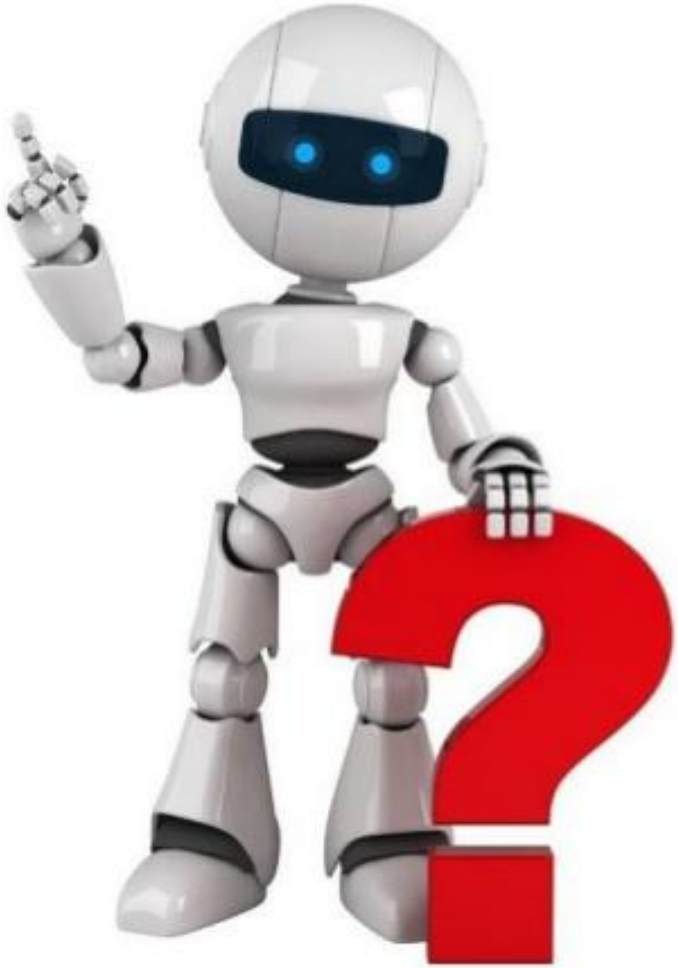

THANK YOU FOR THE ATTENTION!

QUESTIONS?