

DIU SMART CAR PARKING SYSTEM

(IOT Based Smart Car Parking System Project)

This project is submitted for fulfillment the requirement the Award of Degree of BSc in EEE (Bachelor of Science in Electrical and Electronics Technology)

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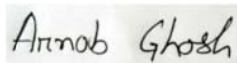
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Special thanks to our families, our friends and our teachers for their unconditional love and support for us.

DEDICATION

**Dedicated To
Our Respectable Parents**

Abstract

In this time most of the smart city gained so many popularity. It is thankful to the evolution of Internet of things the idea of smart city now seems to be achievable. Smart cities are faces so many problems like that populated, traffic congestion, limited car parking facilities and road safety. We present an IOT based cloud integrated **SMART CAR PARKING SYSTEM**. The proposed smart parking system consist of an on site deployment of an IOT module that is used to monitor and signalize the state of availability of each single parking space. We can control it by our **android operated mobile phone** also. From home we can see the parking slot available or engage. Not only this but also we can monitor the each car in time,out time and parking time by **sms** in our phone. We implement this project by using arduino, 2G GSM module and Wi-Fi module And this is very cheap system.

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CHAPTER-1

1. Introduction :

Smart car parking system development by IOT based system. It can send parking data about free and engage places via web or mobile phone application. In this IOT device it is including Microcontroller, GSM module, WiFi module and Sensors are can located each parking place. Admin / user can get the live information data update of the availability of total parking slot and can choose the best parking slot that user want. By investigate technologies of this smart car parking system we innovate an internal research project. Basically the main idea creation of this smart car parking system by using IOT (Internet of Things) and Ultrasonic sensor, where available car parking slot can be displayed in a internet web application.



Fig : 1.1 DIU Smart car parking system

1.1 Objective of the Study

1. To Develop an AI (Artificial Intelligent) user friendly smart car parking system that can decrease manual man power and easy traffic control
2. To make a safe and secured car parking slot in special or limited location.

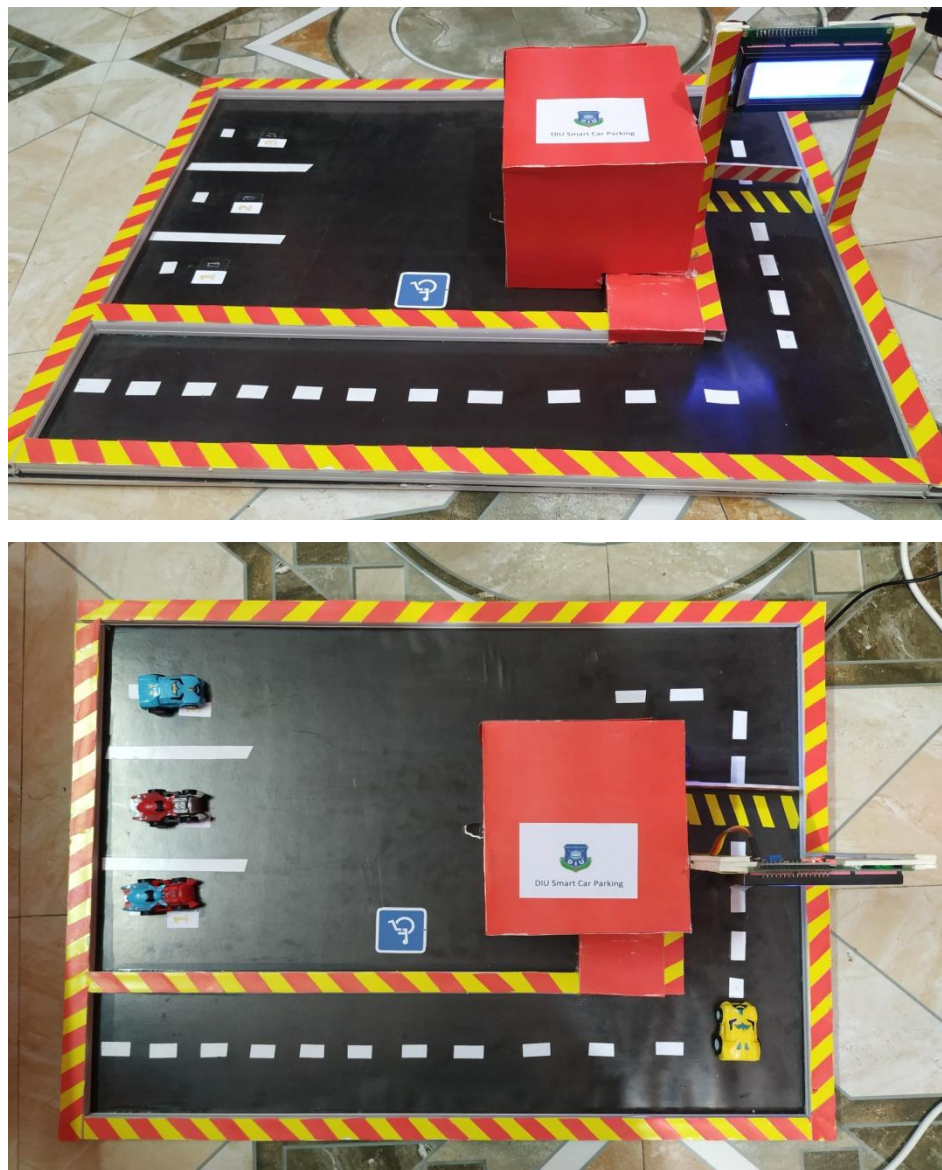


Figure : 1.2 Visual representation of smart parking system

1.2 Working Procedure:

This IOT device made by an ESP8266 microcontroller and a distance measurement sensor which is HC-SR04. The measuring sensor measure the distance and send this data to microcontroller. That is connected with A W S IOT system by the M Q T T protocol. This Electronics device send the measured value data to IOT as a sensor command. These sensor can detect car that is parked in those parking slot by measuring distance by infrared sensor. In our implemented system sensor state will occupied if the distance between range of 100 millimeter or 10 centimeter to 500 millimeter or 50 centimeter and the slot will free if that distance is more than 500 millimeter. By this configured value it represent the status of parking slot that is occupied or free. If the slot is free then user can see “Free” to the display on the other hand if not free then the user can see “Occupied” to the display.

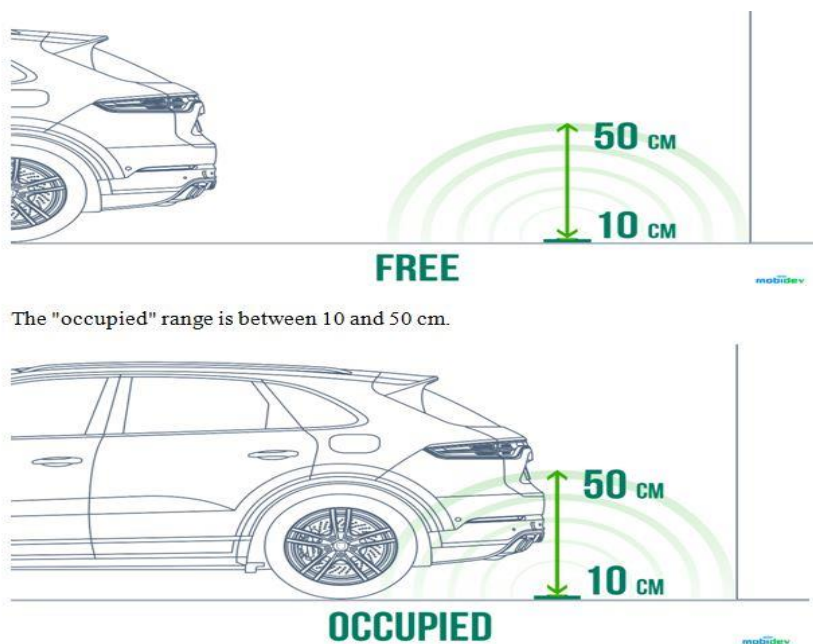


Fig : 1.3 Measuring displacement of sensor.

1.3 Application

We can apply this smart car parking system to a small parking and a multi storage parking garage both of them easily.

This is not so costly and expensive and its system is fully automatic so we need not and manpower to control it. So we can install it every small or large parking garage area.

Free standing garage above ground, under buildings above grade or under building below grade we can imply it every where.

CHAPTER-2

Description of hardware

These hardware components are required for micro controller

- 1) **Arduino nano**
- 2) **Servo motor SG 90**
- 3) **RC 522 FRID module**
- 4) **AC and DC adopter**
- 5) **WiFi module ESP 8266**
- 6) **GSM module SIM800L**

2.1 Arduino nano:

This is small size complete device and it is also breadboard friendly board based device. Though it is a small device but it has more or equal function that arduino duemilanove in a suitable and different circuit. This device has a lack and that is it has dc power jack and it works by using a micro USB cable.



Figure 2.1 : Arduino nano

Specification:

- ❖ MICROCONTROLLER ATMEGA 328
- ❖ Operating voltage 5 volts
- ❖ Recommended input voltage 7-12 volts
- ❖ Limits of input voltage 6-20 volts
- ❖ 14 In/Out digital pins
- ❖ 8 analog input pins
- ❖ 32 Kb of Flash memory
- ❖ 2Kb of SRAM
- ❖ 40 mA DC current per input and output
- ❖ 16 MHz clock speed

2.1 (a) Power:

This Arduino nano takes power by a Micro USB cable and takes 6-20 volts. It can select automatically power source range of highest voltage. There is a FT232 RL chip on this arduino nano and it will be powered if the device is connected with source. If it runs with external power of 3.3 volts then RX and TX LED will flick as digital pins is 0 or 1.

2.1 (b) Arduino nano In/Out pin details :

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to <u>Arduino</u> when using an external power source (6-12V). 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: Ground pins.
Reset	Reset	Resets the microcontroller.

Analog Pins	A0 – A7	Used to measure analog voltage in the range of 0-5V
Input/Output Pins	Digital Pins D0 - D13	Can be used as input or output pins. 0V (low) and 5V (high)
Serial	Rx, Tx	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
IIC	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

2.1 (c) Technical specification of Arduino nano :

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage for Vin pin	7-12V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (2 KB is used for <u>Bootloader</u>)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz
Communication	IIC, SPI, USART

2.1 (d) Block diagram of Arduino Nano

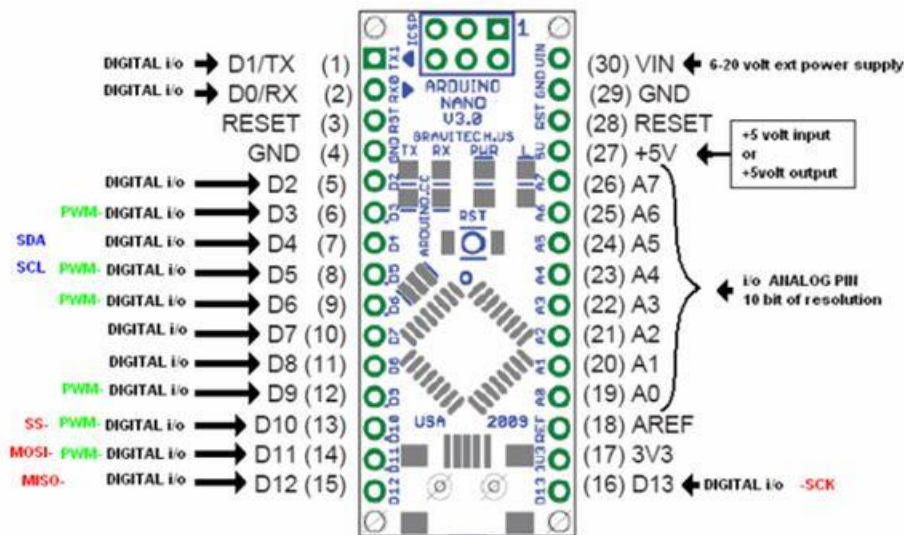


Figure 2.2 : Block diagram of Arduino nano

Input and output:

14 digital each pins can be use in Arduino nano as input and output. It is using for three different function and those are

- ❖ Pin mode
- ❖ Digital write
- ❖ Digital read

These each pins operate by using 40mA and 5 volts and it has also an internal pull up resistor of the range of 20-50 kilo Ohm. There are some special functionalized pin for RX , TX and TTL data serial.

Memory:

ATMEGA 328 has 32Kb of memory as flash memory for storing code. Here its boot loader needs 2Kb. This ATMEGA 328 has 2Kb of SRAM and 1Kb of EEPROM.

LED indicator:

In this arduino there is a built in LED indicator light. That is connected with those digital pins. In operation time if the pin is high then it will turn on and if the pin is low then it will turn off.

2.1 (e) Communication:

In this Arduino nano here is some wonderful facilities for communicating with other Arduino nano, with a computer or with other microcontroller. ATMEGA 328 can provide TTL series communication that is can do by RX and TX pins. It can also communicate by USB cable and FTDI drivers by some computer software. By these software Arduino nano can sent data by Arduino board. When it transmits data the RX and TX LED indicator will blink. This Arduino also supports TWI and SPI communication.

2.1 (f) Programming :

Arduino nano can be programmed with some arduino software by computer according what we want to do by the arduino nano device. We can also bypass it by ICSP program. This is designed to perform any microcontroller operation by arranging a program and there is a very good side that we can also modify those program. So programming is very important for arduino nano board.

2.2 Servo Motor (SG-90)

2.2 (a) Servo motor

There is so many types of servo motors available in buying place but in our project we need a specific servo motor in our work. We know that maximum servo motor is rated DC 5 V to 6.5 V and these motor is for operation of an angle from 0 to 180 degree by there gear arrangement settings and the second factor is the torque. Is this case we choice SG-90 servo motor for our operation.

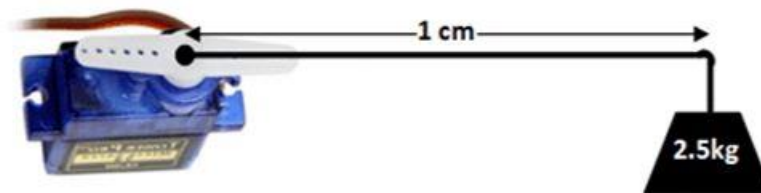


Figure 2.3: Servo motor SG-90

2.2 (b) Application:

- ❖ Used in robots for accurate position control
- ❖ Used for robot movement actuators
- ❖ For RC car steering
- ❖ Used in DOF robot

2.2 (c) Servo motor (SG-90) dimension

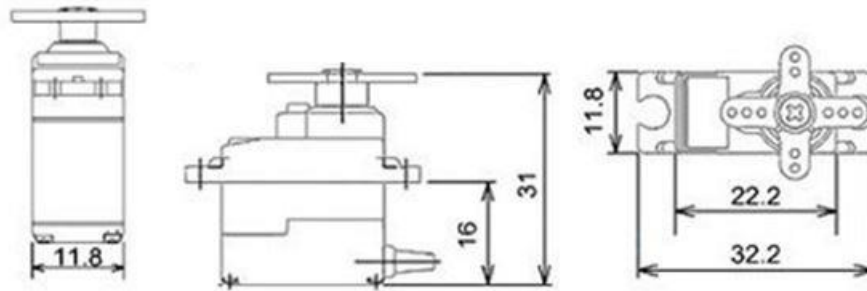


Figure 2.4 : SG-90 dimension

2.2 (d) Wire connection:

Wire Number	Wire Colour	Description
1	Red	For powering the servo motor
2	Brown	Grounding wire for servo motor
3	Orange	For PWM signal to drive

2.2 (e) Feature of SG-90

- ❖ 5 Volts is operating voltage
- ❖ Very light weight of 9 grams
- ❖ Plastic gear type
- ❖ 0 to 180 degree of rotation
- ❖ 2.5KG/Cm of torque

2.3 RFID Module (RC522)

RFID means Radio Frequency Identification. RFID technology basically used for automatic checkout solution. It can identify different kinds of tags. Those tags are attached with some items and this RFID can recognize those tags separately. In our project we use some different tags in some different vehicle as the RFID can recognize those then it will send signal to arduino nano to perform its actions.

For this project this module is very good choice for considering cost because this module and tags are very cheap and low power needed. RFID mainly consist of two things. That is transponder and receiver. Here Transponder known as tag and receiver known as reader. It use high frequency electromagnetic field and the tags are usually a passive device and it needs no power. Transponder through a radio signal to the tags and then that signal return by those tags electromagnetic reflection. An antenna receive that signal.

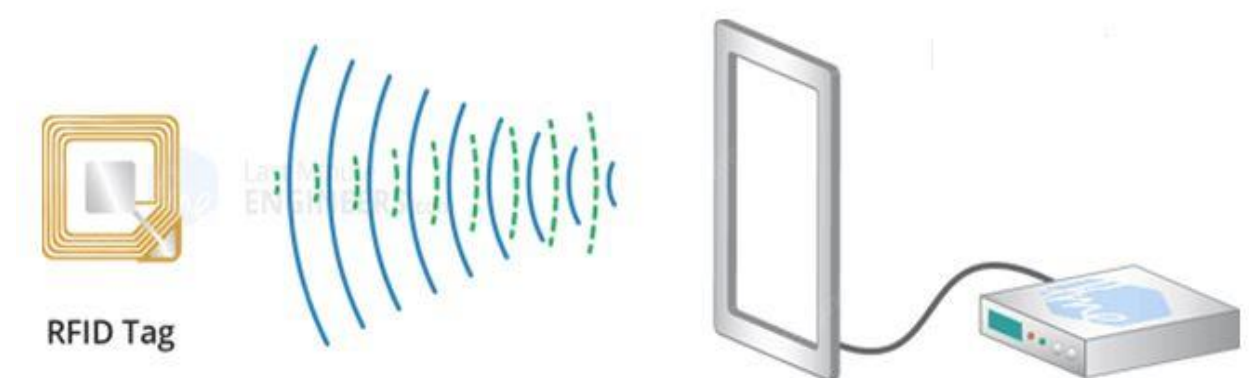


Figure 2.5 RFID Reader (Sender and Receiver)

After receiving that signal the reader generates an electromagnetic frequency to encode that signal of tags. Then encoder send the data to the microcontroller to perform the operation.

2.3 (a) RFID Reader/Writer module (RC522)

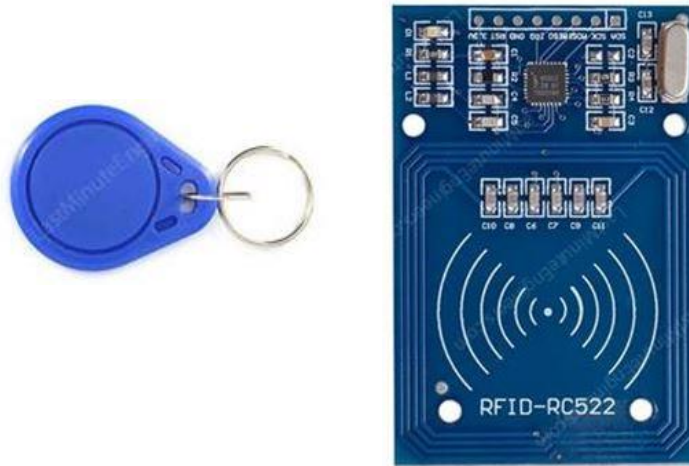


Figure: 2.6 :RFID reader and writer

Here is the reader and writer module. Basically the key ring like object is the tag and the most important thing is it has 1Kb memory so that we can store some important short data to it and only the reader can do read it when it needs.

This module is designed to produce an electromagnetic field of 13.56 MHz for using the communication with RFID tags. Reader can communicate by controller by SPI system with the maximum data rate of 10Mbps. UARTS protocol communication is also supports by this. This module has an operating voltage of 2.5 - 3.5 volts but its logic pins can tolerate up to 5 volts. For this benefit we can connect this module with controller and with the arduino at same board and this is very important matter because we should not need of any logic level converter.

Specification:

- ❖ Has SPI and UART host interface
- ❖ Operating voltage is 2.5 - 3.5 volts
- ❖ 13.56 MHz ISM band frequency range
- ❖ Operating current is 13 -26 mA

- ❖ Logic input is 5 volts tolerable
- ❖ Standard reading range of 5 cm

2.3 (b) RFID Module pinout:

This RFID module is designed with 8 pins to perform its action

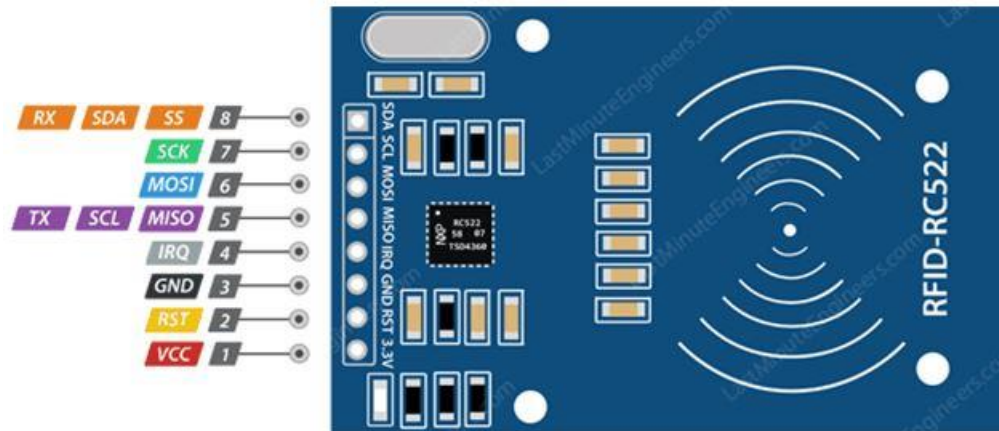


Figure 2.7: RFID module pinout

- ❖ VCC needs supply for it self. This module can operate from 2.5 V to 3.5 V.
- ❖ RST is used for reset input and power down. By put it down it enable power down of internal current.
- ❖ GND is grounding pin and it needs to connect with arduino.
- ❖ IRQ is used as an interrupt pin for microcontroller.
- ❖ MISO SCL and TX is use as master and slave condition applier when we use SPI system.
- ❖ MOSI is used as master out slave in condition applier.
- ❖ SCK is use to put serial clock signal pulse to SPI system.
- ❖ SS SDA and RX is used as signal input for SPI system.

2.3 (c) Application of RFID:

- ❖ Automatic access control system
- ❖ Automatic costing system
- ❖ Automatic screening attendance
- ❖ Automatic Identification system

2.3 (d) RFID pin details

- ❖ VCC for power input to module
- ❖ Ground is for grounding the connection
- ❖ RST is for reset system
- ❖ SCK is for serial clock pin
- ❖ IRQ is for Interrupt pin
- ❖ SS is for serial input

2.3 (e) RFID Features

- ❖ Operating voltage is from 2.5 to 3.5
- ❖ 13.56 MHz Module
- ❖ 10 Mbps data rate
- ❖ SPI & UART communication support
- ❖ 5cm range of reading

2.4 AC/DC adapter

This is a adapter that have the character of 12 volts and 2 A. It is specially manufactured for electronics devices. This adapter is very popular for circuits.

2.4 (a) Specification:

- ❖ Input voltage is 100 to 230 V
- ❖ Output voltage is 12 V
- ❖ Output current is 2A
- ❖ 50 Hz of frequency
- ❖ Output power is 24W

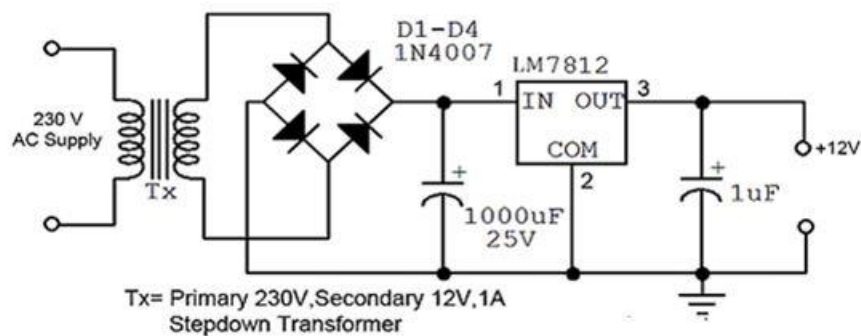


Figure 2.8: AC/DC adapter block diagram

2.5 Wi-Fi Module (ESP 8266)

ESP 8266 is useful and cheap wifi module for controlling devices by internet. It works with a microcontroller as like Arduino nano. It also can be programmed to work on its owns.

ESP 8266 was launched in 2014 after that it become very popular. Though it has only one processor but it found on many different breakout boards. These breakout boards have rapidly evoloped over one year.

2.5 (a) Specification of ESP 8266:

- ❖ Analog to digital conversion
- ❖ General purpose 16 in/out
- ❖ Pulse width modulation
- ❖ 2.4 GHz Wi-Fi supports
- ❖ Direct memory access



Figure 2.9 : Wi-Fi module ESP8266

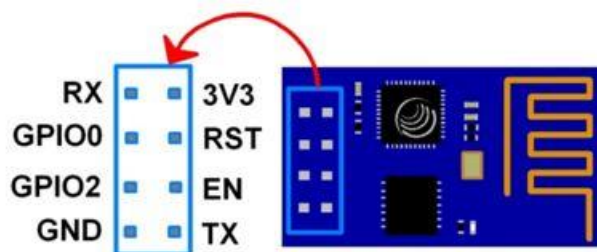
2.5 (b) Application of ESP8266

This module is self contained SOC with integrated IP. It comes pre programmed with an AT command set firmware. This module is very cheap and effective for growing community.

2.5 (c) Power supply for ESP 8266

This ESP 8266 is not capable for 3-5 volts. It requires an external logic level converter LLC. So it should not be powered directly from board.

2.5 (d) ESP 8266 Pin out



- **3V3:** – 3.3 V Power Pin.
- **GND:** – Ground Pin.
- **RST:** – Active Low Reset Pin.
- **EN:** – Active High Enable Pin.
- **TX:** – Serial Transmit Pin of UART.
- **RX:** – Serial Receive Pin of UART.

Figure 2.10: ESP8266 module pinout

2.6 GSM Module (SIM800L)

SIM800L is very cheap and small GSM breakout board with all advantages of SIM900L. In this arduino SIM800L sending and receiving text arduino have never been easier.

2.6 (a) Specification:

- ❖ Chip is SIM800L
- ❖ Operating voltage is 3.7 to 4.2 volts
- ❖ Global quad band networks supports
- ❖ TTL serial port
- ❖ Power module automatically boot



Figure 2.11: GSM Module SIM800L

2.6 (b) Application:

SIM800L from SimCom and arduino UNO are highly recommended due to their popularity and supports from the hobbyist and developer community. SIM800L is a cellular communication module that can make calls, send email and

message and even connect to the internet. This module is intended like a mobile phone but need external peripheral to function properly.

2.6 (c) Power supply for SIM800L

This module need to be powered by 3.7 volts which is common most standard among cellular modules. One might thing of using the arduino 5v and 3.5v for the module but it is not advisable.

CHAPTER 3

SOFTWARE DESCRIPTION

3.1 Blink

Blink make turn an LED for one second and after that it make turn the LED for one second. Most the arduino have this LED.

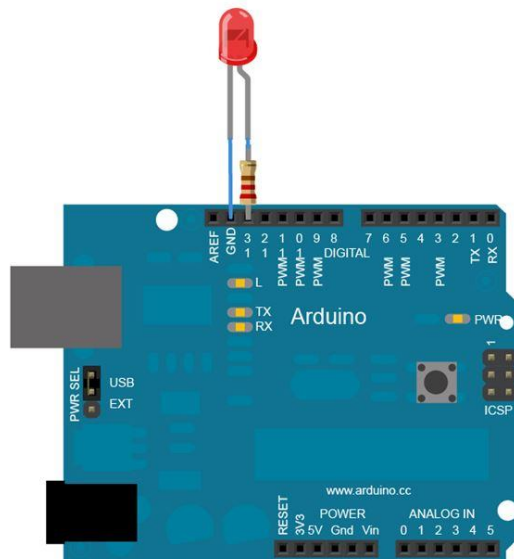


Figure 3.1 BLINK

3.2 Running Arduino Nano

1. Make run the Arduino
2. Open LED Blink sketch by order
3. Chooses tools
4. Select the serial device

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Figure 3.2 Circuit diagram of smart car parking

CHAPTER 4

APPARATUS DESCRIPTION

4.1 20 X 4 LCD Display

LDC means liquid crystal display. In our project we use a 20 x 4 LCD display. 20 x 4 LCD display is very common and basic module for any beginner projects. This 20 x 4 translates on a display is 20 characters per line and has 4 lines. In this display is has 5 x 7 matrix.

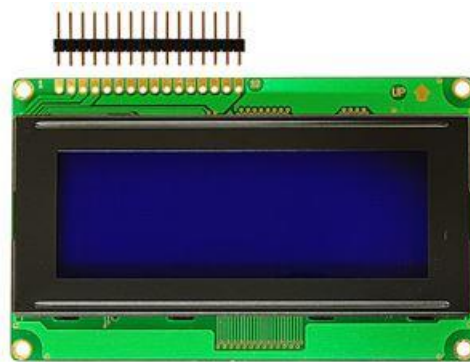


Figure 4.1 : 20 x 4 LCD Display

Register select

20 x 4 display has types of register, namely, command and data. Here is 0 is for command register and 1 is for data register.

Command regisrer:

Command registers store command in display that command is given instruction to show in display.

Data register:

The data register stores the data to the display and show it on display.

Some important command for LCD

- 01 Clear display screen
- 02 Return home
- 04 Decrement cursor
- 06 Increment cursor
- 05 Shift display right
- 07 Shift display left
- 08 Display off
- 0C Display on
- 38 4 lines and 5x7 matrix

Generating custom characters

In LCD display every character is in 5x7 matrix. Here 5 is the column number and 7 is rows number.

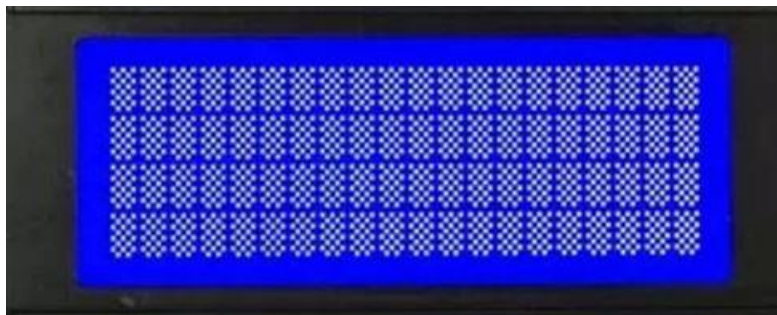


Figure 4.2 : Generate custom character

4.2 Node MCU versions 2

Node MCU is an source of IOT platform including firmware. It is based on an ESP-12 module. It has some features like 4MB of flash memory, 50Kb of ram, 80 Mhz of system clock and a wifi receiver chip. Its operating voltage is DC 6 to 20 volts and recommended voltage is 7 to 12 volts.



Figure 4.3 : NODE MCU V2

4.2 (a) Features :

- ❖ Source is open
- ❖ It is programmable
- ❖ Cost is very low
- ❖ Wi-Fi is enabled
- ❖ Have interactive mode
- ❖ Small and compact in size

4.2 (b) Specification:

- ❖ Including USB and TTL
- ❖ Have 10GPIO
- ❖ Have PCB antenna
- ❖ Exclude battery
- ❖ Weight is 10 grams

4.3 Voltage regulator (IC 7805)

We used a voltage regulator for controlling the dc voltage as needed to the module for using a safe voltage source. We use IC 7805. This IC provides +5 volts regulated from power supply and have a heat sink.

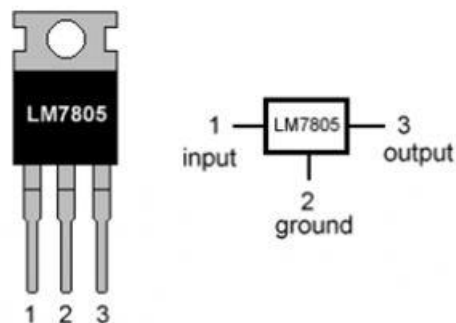


Figure 4.4 : IC 7805

This IC is not very efficient and have voltage dropout problem. Some energy can waste by its heat so we use an heat sink on it so that we can reserve it.

Schematic of IC 7805

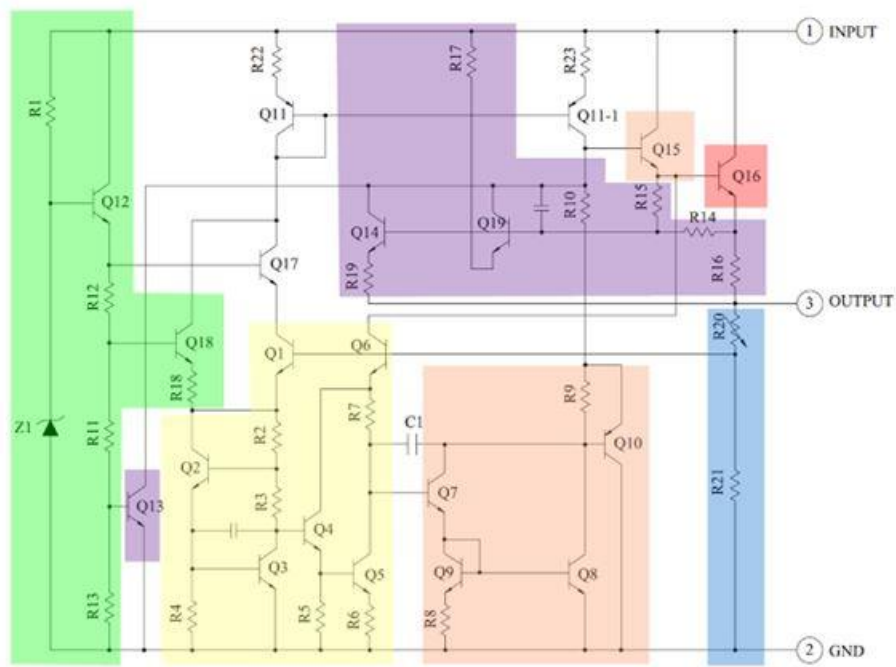


Figure 4.5 : IC 7805 Schematic

4.3 (a) Application area of IC 7805:

- ❖ Output regulator is fixed
- ❖ Circuit is reverse bias protected
- ❖ Adjustable DC voltage
- ❖ Dual supply regulation
- ❖ Positive regulation
- ❖ Reversal protected output polarity

4.4 IR Sensor TCRT5000

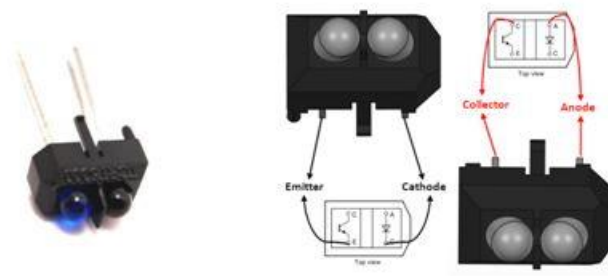


Figure : 4.6 IR Sensor

Specification:

- ❖ Sensor has transistor output
- ❖ Operating temp. -25 degree to +85 degree
- ❖ Analog or digital output
- ❖ 60mA Forward current
- ❖ 5volts operating voltage

4.5 20 x 4 LCD display module

This 12c 20 x 4 screen has a 12c communication interface. It can display 20 x 4 character on 4 lines. We can connect the 12 pins to direct to pin socket and no need to soldering on these pins. All this pins are serial bus and it need to powered by 3.3 volts or 5 voltes.

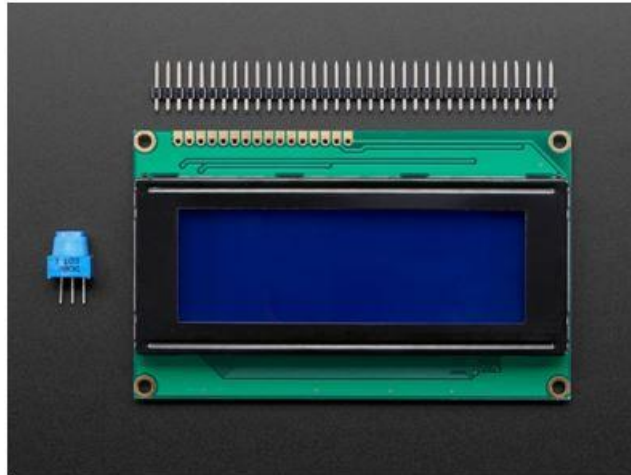


Figure 4.7 : 20 x 4 LCD display module pins.

4.5 (a) Specifications:

- ❖ Useable with various types of Arduino
- ❖ 12C address having
- ❖ Adjustable contrast
- ❖ Blue back ground with white text
- ❖ 5volts of supply voltage
- ❖ Have backlit
- ❖ Size 82mm x 35mm x 18mm
- ❖ Have interface address

CHAPTER 5

CONCLUSIONS AND FUTURE

5.1 Advantage of smart car parking :

- ❖ **Reduce Traffic** : traffic flow will get reduce because this parking users can get parking slot automatically.
- ❖ **Optimized parking** : User can find best parking slot by IOT system.
- ❖ **Reduce pollution** : By optimized parking system vehicle will burn less fuel.
- ❖ **Enhanced user experience** : This smart car parking system will integrate entire system and give a better experience.
- ❖ **Increase safety** : User will get a safety can parking because only registered user will have the gate pass and entering access.
- ❖ **Reducing time** : it will take less than manual parking garage because here is every thing is automatic.
- ❖ **Storing data** : User and parking owner can store and see all data of parking every vehicle as par real time.
- ❖ **Increase service** : user will get a better service from this parking slot.

5.2 Disadvantage of Smart car parking:

- ❖ **Maintenance**: In a multi storage parking there are so many vehicle and people comes every day and the parking capacity is so large. That's why it needs to maintenance routinely.
- ❖ **Parking skills**: In this parking driver need to have a good parking skills.

5.3 Conclusion

This system can save time and traffic and avoiding time wasting. Developed cities can have a great efficiency and security. Smart parking system also can solve population problem and vandalism. Fuel saving also possible by smart car parking system.

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