



Date \_\_\_\_\_

MTWTFSS

## Embedded Notes

IDE

Arduino → Microchip Studio

Current → 3-3V

motor 3-3V

not work

Why?

motor drive

need more

current

Amperes needed to move

24 bit ADC → 6bit signal

use

ADC pin

then

Arduino <sup>pin</sup>

give display to Raspberry Pi?

done  
no

both must be on same communication protocol

### Security

 → edge device

## LED / LCD Interfacing

### Serial Data Transfer

1 pin

3 bits

34 s

### Parallel Data Transfer

34 pins

serial data

1 s

RESET PIN →

(Can use  
for LED  
Interfacing)

23 pins!

6 ADC - 10 bit

resolution

PDD - PDT (Port D)



Date \_\_\_\_\_

Receive  
or  
transmit → serial data transfer

MTWTFSS

~~PWM~~ PWM

pulse width  
modulation



Vcc

GND

Volt

DMM check

Digital Input

Analog Input

Digital Output

Analog Output

infinite  
values

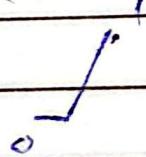
PWM

Pulse width modulation

Digital but mode is  
like Analog or

Motor Start

Duty Cycle



it does

Motor is slow  
if does not

we have same if



Date \_\_\_\_\_

M T W T F S

graphical form  
Schematic → soft components

PCB → Printed copper board

firmware

Inductors

Connectors

→ to connect two  
things

Diodes

Digital Twin

Simulator

Delay in serial

FPGA • gate

design microcontroller

microprocessor

Fourier series transform

frequencies to all axis of k k coordinates

Wave as in

SPT → C

microprocessor works

Arduino

SPI

protocol

Raspberry Pi

very fast

we need  
delay

Raspberry Pi → ADC X

(Arduino → ADC)

IDE load module

Special registers

DDRD → Data directional register

ate \_\_\_\_\_

M T W T F S



Microcontroller → Microprocessor

8

Microchip Studio

Delays are very important

light  $50\text{Hz}$  50 lines on  
and off

Frequency modulated  
Converter

pins 1 or 0

$1\text{GHz}$  Microprocessor

Crystal Oscillator  
effects ~~eff~~ delay

What delay you want you  
have to use that type of  
crystal oscillator



[M] [T] [W] [T] [F] [S]

Date

VCC → Microprocessor  
GND

VCC Clock → Microprocessor  
GND Oscillator  
↓

Synchronization  
Communication

Clock frequency is necessary

1MHz  $\frac{1}{10^6}$  s = 1μs

1 instruction = 1 clock cycle

↓  
upto 4

[255]

8 bit register

EPROM

16x16 bits

Data Memory

256x128 bits

ATtiny

• her → memory 64

Date \_\_\_\_\_

[M T W T F S]



Micro Controller  
Arduino (protection)

Arduino - Uno

\$ Chip → Atmel

Uno - Q

Nano - Blc.

64 bits (Pin must be greater than 64)

Cross Complex

↓  
work on multiple development boards

Daughter board



PMW

motor run through PWM

Analog write Control

DAC

Digital to Analog Conversion



12 bit ADC

$2^{12}$

0 - 1024 variations

Analog Sensor → ADC - 10bit → 0 - 1024 value between 1024

↓  
↓

0

Temperature Sensor →  $150^{\circ}\text{C}$  →  $-5^{\circ}\text{C}$  → electrical signal → 10mV variations

150      1023  
|            |  
 $-5^{\circ}\text{C}$       map       $150^{\circ}\text{C}$

①

[  
USB  
can save  
more power]

Two Power Supply

External power supply  
needed

$-5^{\circ}\text{C} \rightarrow 0$  value

$150^{\circ}\text{C} \rightarrow 1023$  value

Date \_\_\_\_\_

(M/T/W/T/F/S)

code studies

Serial Communication

bot race

PIN mode 3 output

PIN mode 4 INPUT

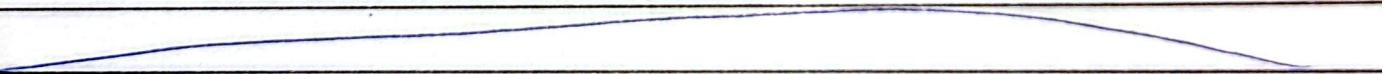
Digital write

Digital read

Analog write

Analog read

Delay (Secs)

crystal oscillator  
is fixed here

Date \_\_\_\_\_

(M T W T F S)



Arduino - Raspberry Pi;

Communication

Serial port.

(CAN)

Controller Area Control

Ultrasonic

Ultrasonic  
sensor

Sensor → data input  
or output both

Digital sensor → connect - Arduino

Transmitter 5V → On time & Off  
receiver Ground

Sensor Arduino Echo

1, 0 → operate

Transmitter sensor  
activate activate

Weight

distance  
calculate

at how much  
line wave -  
comes back  
of sensor

wavelength

frequency

orange  
matter

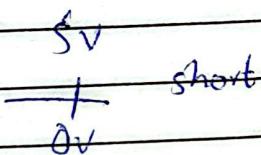
Date \_\_\_\_\_

MTWTFSS

Low frequency - less directions

$1 \rightarrow 5V$       X  
 $0 \rightarrow 0V$

no component  
 when voltage drop



DIODE  $0V >$  electrons flow

LED + resistor

switch      diode short

Date \_\_\_\_\_

[M] [T] [W] [T] [F] [S]



DV

Auditor PIN ①

switch  
press

resistor  $\rightarrow$  infinity

release  $\rightarrow$  DV

infinite resistance

switch  
press      DV  
              set

when  
not press  $\rightarrow$  no guarantee it will  
set 0 V, +

Pulse logic  
voltage

there is a guarantee will set 0

photo diode

Duty cycle

DC ↑

Motor  $\rightarrow$  Digital signal  $\rightarrow$  Continuous DV



Duty cycle the syada

motor is not off then it  
neither on.

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Duty cycle less

How to turn off motor

it will not start again

Duty cycle variable

specific pin in arduino

pulse width modulation

motor → coil

Energy Relais

M T W T F S



Castelli

