GND
3V3

U2
STM32F103C8T6TR

VDD_3
VSS_3
PB9
PB8
BOOT0
PB7
PB6
PB5
PB4
PB3
PA15
PA14

CAN TX
CAN RX
BOOT0
USR BTN
LED
EN2 B
EN2 A
EN1 B
EN1 A
SWCLK

1 VBAT
2 PC13-TAMPER-RT_C
3 PC14-OSC32_IN
4 PC15-OSC32_OUT
5 PD0-OSC_IN
6 PD1-OSC_OUT
7 NRST
8 VSSA
9 VDDA
10 PA0-WKUP
11 PA1
12 PA2

CS0 STM
CS1 STM
CS2 STM
OSC IN
OSC OUT
NRST
AN0
AN1
AN2

VDD_2 36
VSS_2 35
PA13 34
PA12 33
PA11 32
PA10 31
PA9 30
PA8 29
PB15 28
PB14 27
PB13 26
PB12 25

3V3   GND

SWDIO
D+
D-
RXSTM
TXSTM
PPM STM
MOSI STM
MISO STM
SCK STM
IO5

PA3
PA4
PA5
PA6
PA7
PB0
PB1
PB2
PB10
PB11
VSS_1
VDD_1

13 14 15 16 17 18 19 20 21 22 23 24

AN3
AN4
AN5
IO0
IO1
IO2
IO3
IO4
SCL
SDA

3V3
GND

J14
3V3   1
SWCLK   2   SWCLK
GND   3
SWDIO   4   SWDIO
SWD

3V3   GND   3V3   GND   GND   GND

C12
CAP 0805 X7R 16V
10uF
C16
CAP 0805 X7R 16V
10uF
C18
CAP 0805 X7R 16V
10uF

C13
CAP 0603 X7R 16V
0.1uF
C17
CAP 0603 X7R 16V
0.1uF
C19
CAP 0603 X7R 16V
0.1uF

C14
CAP 0603 X7R 16V
20pF
C15
CAP 0603 X7R 16V
20pF

X32258MSB4SI
Y1
OSC IN   OSC OUT
GND

EN1 A   C6   CAP 0603 X7R 16V   1nF
EN1 B   C7   CAP 0603 X7R 16V   1nF
EN2 A   C8   CAP 0603 X7R 16V   1nF
EN2 B   C9   CAP 0603 X7R 16V   1nF
GND

3V3   R9   RES 0603 5%   10k
NRST
C10   CAP 0603 X7R 16V   10nF
SW1   K2-1109DP-J4SW-01
1 4
2 3
GND

3V3   R13   RES 0603 5%   10k
USR BTN
C11   CAP 0603 X7R 16V   10nF
SW2   K2-1109DP-J4SW-01
1 4
2 3
GND

GND
TPD2EUSB30ADRTR
U13
3 GND
1 D+
2 D-
D P
D N

R4   RES 0603 5%   4.7k   GND
D+   R5   RES 0603 5%   20R   D P
D-   R6   RES 0603 5%   20R   D N

3V3
SCL   R7   RES 0603 5%   10k
SDA   R8   RES 0603 5%   10k

RXSTM   R10   RES 0603 5%   100R   RX STM
TXSTM   R11   RES 0603 5%   100R   TX STM

BOOT0   R12   RES 0603 5%   10k   GND

PPM STM   R56   RES 0603 5%   NC   PPM

GND
U3
1 GND   DOUT 4
2 DIN   VDD 3
WS2812E-V5
3V3

R14   RES 0603 5%   100R   LED

Robot Controller v1.0 Detailed Schematic Explanation

This schematic represents the detailed design of a robot controller circuit centered around the STM32F103 microcontroller.

Below is a breakdown of the sections:

1. Microcontroller (U2)

- STM32F103C8T6: A 32-bit ARM Cortex-M3 microcontroller that forms the core of this design.

- Key Pins and Connections:

  - Power Pins:

    - VBAT: Backup battery input for RTC functionality.

    - VDD/VDDA: 3.3V supply lines for digital and analog sections.

    - VSS/VSSA: Ground connections for digital and analog sections.

  - Oscillator Pins:

    - OSC_IN/OSC_OUT: Connected to an external 8 MHz crystal (Y1) and decoupling capacitors (C14, C15) for clock generation.

  - Programming Pins:

    - SWCLK and SWDIO: Used for programming and debugging via the SWD interface.

  - GPIOs: General-purpose input/output pins (PAx, PBx) used for peripherals and communication.

  - NRST: Reset line connected to a push button (SW1) for manual resets.

2. Power Supply and Decoupling

- The circuit runs on a 3.3V supply, distributed through multiple decoupling capacitors (e.g., C12, C13, C19) placed near key components to stabilize voltage.

3. External Oscillator

- Y1: An 8 MHz crystal oscillator provides a stable clock for the microcontroller, stabilized using capacitors (C14, C15).

4. USB Connector (U13)

- Type-B USB connector serves as a communication interface.

  - D+ and D-: USB data lines conditioned by resistors (R4, R5).

  - GND and 3.3V: Provide power and ground for the USB interface.

5. Communication Interfaces

- I2C: SCL (PB6) and SDA (PB7) lines are used for I2C communication with pull-up resistors (R7, R8).

- UART: RXSTM and TXSTM lines facilitate serial communication.

- SPI: SPI lines (MOSI, MISO, SCK, CS) are available for external peripherals.

6. Buttons and Switches

- Reset Button (SW1): Provides manual reset functionality with a pull-up resistor (R9) and capacitor (C10) for debounce.

- User Button (SW2): A user-defined programmable button with a pull-up resistor (R13).

7. LED Indicator

- A simple LED circuit with a resistor (R14) is included for status indication.

8. Motor Driver Enable

- EN1 and EN2: Enable lines for motor drivers with capacitors (C5, C6, etc.) to filter noise.

9. Additional Information

- Project Title: Robot Controller v1.0.

- Author: Ruchira Tilan Munasinghe.

- Date: July 10, 2023.

- Organization: Orise.

This circuit is optimized for embedded robotic systems, ensuring reliable operation with provisions for communication, debugging, and control.