CoDrone LINK

Communication

Bluetooth Low Energy

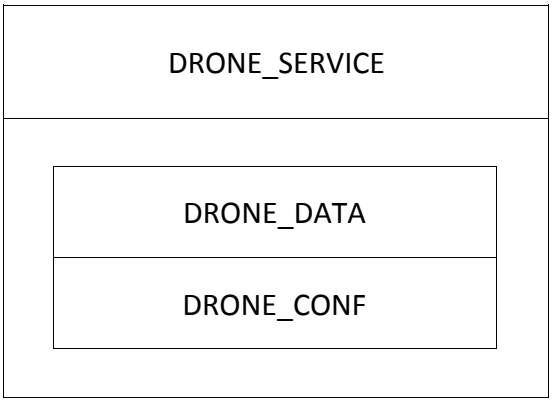
Updated in April 14th, 2016

Contents

1. Introduction
2. Data Link
3. Data Structure

1. Introduction

CoDrone uses Bluetooth Low Energy (BLE) technology.



Name	UUID	Purpose
DRONE_SERVICE	"C320DF00-7891-11E5-8BCF-FEFF819CDC9F"	Service
DRONE_DATA	"C320DF01-7891-11E5-8BCF-FEFF819CDC9F"	CoDrone -> Device(Notify)
DRONE_CONF	"C320DF02-7891-11E5-8BCF-FEFF819CDC9F"	Device -> CoDrone (Write)

2. Data Link

CoDrone takes data from a device through **DRONE_CONF**.
CoDrone sends data to a device through **DRONE_DATA**.

<The array of **DRONE_DATA** and **DRONE_CONF**>

1	2	…	n-1	n
DataType	Data (1)	Data (2)	Data (n-1)	Data (n)

The length of data is not fixed, but the maximum length is 20 bytes.
We recommend to set a data transfer cycle of 50 ms for Android and 100ms for iOS.

When CoDrone is asked to send a particular data, it sends the date required.
When CoDrone takes normal commands, it sends **Ack** back for response.
However, when it takes control commands for moving, it doesn't send **Ack** back.

If you want to receive data from CoDrone to your device, you need to enable "notification" in your application.

<DataType>

```
enum DataType
{
        None = 0,

        // system information
        Ping,                   ///< check communication(reserved)
        Ack,                    ///< response to receiving data
        Error,                  ///< error(reserved)
        Request,                ///< data request
        Passcode,               ///< reset password for pairing
        // control, command
        Control = 0x10,         ///< control
        Command,                ///< command
        Command2,               ///< multiple command (command 1, 2)
        Command3,               ///< multiple command (command 1, 2, 3)

        // LED
        LedMode = 0x20,         ///< set single LED mode
        LedMode2,               ///< set double LED mode
        LedModeCommand,         ///< LED mode, command
        LedModeCommandIr,       ///< LED mode, command, IR data transfer
        LedModeColor,           ///< LED mode, set single RGB color respectively
        LedModeColor2,          ///< LED mode, set double RGB color respectively

        LedEvent,               ///< single LED event
        LedEvent2,              ///< double LED event
        LedEventCommand,        ///< LED event, command
        LedEventCommandIr,      ///< LED event, command, IR data transfer
        LedEventColor,          ///< LED event, set single RGB color respectively
        LedEventColor2,         ///< LED event, set double RGB color respectively

        LedModeDefaultColor,    ///< LED default mode, set single RGB color respectively
        LedModeDefaultColor2,   ///< LED default mode, set double RGB color respectively

        // drone condition
        Address = 0x30,         ///< IEEE address
        State,                  ///< state(flight mode, coordinate, battery)
        Attitude,               ///< attitude
        GyroBias,               ///< gyro bias
        TrimAll,                ///< fine adjustment
        TrimFlight,             ///< fine adjustment in flight mode
        TrimDrive,              ///< fine adjustment in drive mode

        // Sensor
        ImuRawAndAngle = 0x50,  ///< IMU raw data, Angle
        Pressure,               ///< pressure sensor data
        ImageFlow,              ///< optical flow sensor
        Button,                 ///< button input
        Battery,                ///< battery
        Motor,                  ///< motor control input vales
        Temperature,            ///< temperature


        // data transfer
        IrMessage = 0x40,       ///< IR data transfer

        EndOfType
}
```

3. Data Structure

```
typedef     int32_t         s32;
typedef     int16_t         s16;
typedef     int8_t          s8;

typedef     uint32_t        u32;
typedef     uint16_t        u16;
typedef     uint8_t         u8;
```

3.1. Base

3.1.1. CommandBase

```
struct CommandBase
{
        u8      commandType;    ///< command type
        u8      option;         ///< option for command(use the defined value in System.h)
};
```

CommandBase is a basic structure to ask CoDrone for something, using in structures of **Command**, **Command2**, **Command3**, **LedModeCommand**, **LedModeCommandIr**, **LedEventCommand**, **LedEventCommandIr**

3.1.1.1. CommandType

```
enum CommandType
{
        None = 0,               ///< no event

        // setting
        ModePetrone = 0x10,     ///< change petrone mode

        // control
        Coordinate = 0x20,      ///< change coordinate
        Trim,                   ///< change fine adjustment value
        FlightEvent,            ///< execute flight event
        DriveEvent,             ///< execute drive event
        Stop,                   ///< stop

        ResetHeading = 0x50,    ///< Reset heading
        ClearGyroBiasAndTrim,   ///< Reset gyrobias and fine adjustment value

        // connection
        PairingActivate = 0x80, ///< enable pairing
        PairingDeactivate,      ///< disable pairing
        TerminateConnection,    ///< connection terminates

        // request
        Request = 0x90,         ///< request data

        EndOfType
};
```

3.1.1.2. Option

Please check the option value of **ModePetrone**, **Coordinate**, **Trim**, **FlightEvent** or **DriveEvent** in **CommandType**.

3.1.1.2.1. ModePetrone

```
{
        None = 0,

        Flight = 0x10,              ///< flight mode with guards
        FlightNoGuard,              ///< flight mode without guards
        FlightFPV,                  ///< flight mode (FPV)

        Drive = 0x20,               ///< drive mode
        DriveFPV,                   ///< drive mode(FPV)

        Test = 0x30,                ///< test mode

        EndOfType
};
```

3.1.1.2.2. Coordinate

```
enum Coordinate
{
        None = 0,

        Absolute,                   ///< fixed coordinate
        Relative,                   ///< relative coordinate

        EndOfType
};
```

3.1.1.2.3. Trim

```
enum Trim
{
        None = 0,

        RollIncrease,               ///< Roll up
        RollDecrease,               ///< Roll down
        PitchIncrease,              ///< Pitch up
        PitchDecrease,              ///< Pitch down
        YawIncrease,                ///< Yaw up
        YawDecrease,                ///< Yaw down
        ThrottleIncrease,           ///< Throttle up
        ThrottleDecrease,           ///< Throttle down

        EndOfType
};
```

3.1.1.2.4. FlightEvent

```
enum Trim
{
        None = 0,

        TakeOff,                    ///< takeoff

        FlipFront,                  ///< flip
        FlipRear,                   ///< flip
        FlipLeft,                   ///< flip
        FlipRight,                  ///< flip
```

```
        Stop,                   ///< stop
        Landing,                ///< landing
        Reverse,                ///< turtle turn

        Shot,                   ///< motion when shooting
        UnderAttack,            ///< motion under attack
        Square,                 ///< square flight
        CircleLeft,             ///< circle flight(left)
        CircleRight,            ///< circle flight(right)
        Rotate180,              ///< rotate 180 degrees

        EndOfType
};
```

3.1.1.2.5. Request

```
enum DataType
{
        // drone condition
        Address = 0x30,         ///< IEEE address
        State,                  ///< state(flight mode, coordinate, battery)
        Attitude,               ///< attitude(Vector)
        GyroBias,               ///< gyro bias(Vector)
        TrimAll,                ///< fine adjustment
        TrimFlight,             ///< fine adjustment in flight mode
        TrimDrive,              ///< fine adjustment in drive mode

        // Sensor
        ImuRawAndAngle = 0x50,  ///< IMU raw data, Angle
        Pressure,               ///< pressure sensor data
        ImageFlow,              ///< optical flow sensor
        Button,                 ///< button input
        Battery,                ///< battery
        Motor,                  ///< motor control input vales
        Temperature,            ///< temperature
};
```

3.1.2. LedModeBase

LedModeBase is a basic structure to change various LED modes.

```
struct LedModeBase
{
        u8      mode;           ///< LED mode
        u8      color;          ///< LED color
        u8      interval;       ///< LED interval
};
```

3.1.2.1. mode

```
enum ModeLight
{
        None = 0,

        EyeNone = 0x10,
        EyeHold,                ///< hold color
        EyeMix,                 ///< change color continuously
        EyeFlicker,             ///< flicker
        EyeFlickerDouble,       ///< flicker
        EyeDimming,             ///< control brightness and dimming

        ArmNone = 0x40,
        ArmHold,                ///< hold color
        ArmMix,                 ///< change color continuously
```

```
        ArmFlicker,                 ///< flicker
        ArmFlickerDouble,           ///< flicker
        ArmDimming,                 ///< control brightness and dimming
        ArmFlow,                    ///< front to rear
        ArmFlowReverse,             ///< rear to front

        EndOfType
};
```

3.1.2.2. Color

```
enum Colors
{
        AliceBlue,              AntiqueWhite,           Aqua,
        Aquamarine,             Azure,                  Beige,
        Bisque,                 Black,                  BlanchedAlmond,
        Blue,                   BlueViolet,             Brown,
        BurlyWood,              CadetBlue,              Chartreuse,
        Chocolate,              Coral,                  CornflowerBlue,
        Cornsilk,               Crimson,                Cyan,
        DarkBlue,               DarkCyan,               DarkGoldenRod,
        DarkGray,               DarkGreen,              DarkKhaki,
        DarkMagenta,            DarkOliveGreen,         DarkOrange,
        DarkOrchid,             DarkRed,                DarkSalmon,
        DarkSeaGreen,           DarkSlateBlue,          DarkSlateGray,
        DarkTurquoise,          DarkViolet,             DeepPink,
        DeepSkyBlue,            DimGray,                DodgerBlue,
        FireBrick,              FloralWhite,            ForestGreen,
        Fuchsia,                Gainsboro,              GhostWhite,
        Gold,                   GoldenRod,              Gray,
        Green,                  GreenYellow,            HoneyDew,
        HotPink,                IndianRed,              Indigo,
        Ivory,                  Khaki,                  Lavender,
        LavenderBlush,          LawnGreen,              LemonChiffon,
        LightBlue,              LightCoral,             LightCyan,
        LightGoldenRodYellow,   LightGray,              LightGreen,
        LightPink,              LightSalmon,            LightSeaGreen,
        LightSkyBlue,           LightSlateGray,         LightSteelBlue,
        LightYellow,                    Lime,                   LimeGreen,
        Linen,                  Magenta,                Maroon,
        MediumAquaMarine,       MediumBlue,             MediumOrchid,
        MediumPurple,           MediumSeaGreen,         MediumSlateBlue,
        MediumSpringGreen,      MediumTurquoise,        MediumVioletRed,
        MidnightBlue,           MintCream,              MistyRose,
        Moccasin,               NavajoWhite,            Navy,
        OldLace,                Olive,                  OliveDrab,
        Orange,                 OrangeRed,              Orchid,
        PaleGoldenRod,          PaleGreen,              PaleTurquoise,
        PaleVioletRed,          PapayaWhip,             PeachPuff,
        Peru,                   Pink,                   Plum,
        PowderBlue,             Purple,                 RebeccaPurple,
        Red,                    RosyBrown,              RoyalBlue,
        SaddleBrown,            Salmon,                 SandyBrown,
        SeaGreen,               SeaShell,               Sienna,
        Silver,                 SkyBlue,                SlateBlue,
        SlateGray,              Snow,                   SpringGreen,
        SteelBlue,              Tan,                    Teal,
        Thistle,                Tomato,                 Turquoise,
        Violet,                 Wheat,                  White,
        WhiteSmoke,             Yellow,                 YellowGreen,

        EndOfType
};
```

3.1.2.3. interval

The range of value is 0~255.

3.1.3. ColorBase

ColorBase is a basic structure to control the brightness of R, G or B LED respectively.
The range is 0 ~ 255.

```
struct ColorBase
{
    u8      r;      ///< LED Red
    u8      g;      ///< LED Green
    u8      b;      ///< LED Blue
};
```

3.1.4. LedModeColorBase

LedModeColorBase is a basic structure to change the mode of LEDs with controlling the brightness of R, G or B LED respectively.

```
struct LedModeColorBase
{
    u8          mode;       ///< LED mode
    ColorBase   color;      ///< LED color(R, G, B)
    u8          interval;   ///< LED interval
};
```

3.1.4.1. mode

Refer to **3.1.2.1. mode**

3.1.4.2. color

Refer to **3.1.3. ColorBase**

3.1.4.3. interval

Refer to **3.1.2.3. interval**

3.1.5. LedEventBase

```
struct LedEventBase
{
    u8      event;      ///< LED event
    u8      color;      ///< LED event color
    u8      interval;   ///< LED event interval
    u8      repeat;     ///< LED event repeat
};
```

3.1.5.1. event

Refer to **3.1.2.1. mode**

3.1.5.2. color

Refer to **3.1.2.2. Color**

3.1.5.3. interval

Refer to **3.1.2.3. interval**

3.1.5.4. repeat

The range is 1~255.

3.1.6. LedEventColorBase

```
struct LedEventColorBase
{
	u8		event;		///< LED event
	ColorBase	color;		///< LED event color(R, G, B)
	u8		interval;	///< LED event interval
	u8		repeat;		///< LED event repeat
};
```

3.1.6.1. event

Refer to **3.1.2.1. mode**

3.1.6.2. color

Refer to **3.1.3. ColorBase**

3.1.6.3. interval

Refer to **3.1.2.3. interval**

3.1.6.4. repeat

The range is 1~255.

3.1.7. MotorBase

```
struct MotorBase
{
	s16		forward;
	s16		reverse;
};
```

3.2. Structures

3.2.1. Ack

Ack is a response data when CoDrone receives commends except data of Flight/Drive control command.

```
struct Ack
{
	u32		systemTime;	///< receiving time
	u8		dataType;	///< type of receiving data
};
```

3.2.2. Request

Request is used when you want to get data from CoDrone.
Refer to **3.1.1.2.5. Request**.

```
struct Request
{
	u8		dataType;		///< datatype to be requested
};
```

3.2.3. Control

Control is information about CODRONE's movement.

```
struct Control
{
	s8		roll;		///< Roll(left/right)
	s8		pitch;		///< Pitch(front/rear)
	s8		yaw;		///< Yaw(heading)
	s8		throttle;	///< Throttle(up/down)
};
```

Name	Type	Range	Note
roll	s8	-100 ~ 100	Left: - / Right: +
pitch	s8	-100 ~ 100	Rear: - / Front: +
yaw	s8	-100 ~ 100	Heading Counterclockwise: - / Clockwise: +
throttle	s8	-100 ~ 100	Down: - / UP: +

3.2.4. Command

Refer to **3.1.1. CommandBase**.

```
struct Command
{
	CommandBase		command;
};
```

3.2.5. Command2

Refer to **3.1.1. CommandBase**.

```
struct Command2
{
	CommandBase		command1;
	CommandBase		command2;
};
```

3.2.6. Command3

Refer to **3.1.1. CommandBase**.

```
struct Command3
{
	CommandBase		command1;
	CommandBase		command2;
	CommandBase		command3;
};
```

3.2.7. LedMode

Refer to **3.1.2. LedModeBase**.

```
struct LedMode
{
	LedModeBase		ledMode;
};
```

3.2.8. LedMode2

Refer to **3.1.2. LedModeBase**.

```
struct LedMode2
{
	LedModeBase		ledMode1;
	LedModeBase		ledMode2;
};
```

3.2.9. LedModeCommand

Refer to **3.1.2. LedModeBase** and **3.1.1. CommandBase**.

```
struct LedModeCommand
{
	LedModeBase		ledMode;
	CommandBase		command;
};
```

3.2.10. LedModeCommandIr

Refer to **3.1.2. LedModeBase** and **3.1.1. CommandBase.**
The size of **irData** is 32bits(4bytes).
Control Device =”**irData**” => CODRONE(IR Transmitter) => another CODRONE(IR Receiver) =”**IrMessage**”=> another Control Device

```
struct LedModeCommandIr
{
	LedModeBase		ledMode;
	CommandBase		command;
	u32			irData;
};
```

3.2.11. LedModeColor

Refer to **3.1.4. LedModeColorBase**.

```
struct LedModeColor
{
	LedModeColorBase	ledModeColor;
};
```

3.2.12. LedModeColor2

Refer to **3.1.4. LedModeColorBase**.

```
struct LedModeColor2
{
	LedModeColorBase	ledModeColor1;
	LedModeColorBase	ledModeColor2;
};
```

3.2.13. LedEvent

Refer to **3.1.5. LedEventBase**.

```
struct LedEvent
{
        LedEventBase            ledEvent;
};
```

3.2.14. LedEvent2

Refer to **3.1.5. LedEventBase**.

```
struct LedEvent2
{
        LedEventBase            ledEvent1;
        LedEventBase            ledEvent2;
};
```

3.2.15. LedEventCommand

Refer to **3.1.5. LedEventBase** and **3.1.1. CommandBase**.

```
struct LedEventCommand
{
        LedEventBase            ledEvent;
        CommandBase             command;
};
```

3.2.16. LedEventCommandIr

Refer to **3.1.5. LedEventBase** and **3.1.1. CommandBase**.

```
struct LedEventCommandIr
{
        LedEventBase            ledEvent;
        CommandBase             command;
        u32                     irData;
};
```

3.2.17. LedEventColor

Refer to **3.1.6. LedEventColorBase**.

```
struct LedEventColor
{
        LedEventColorBase       ledEventColor;
};
```

3.2.18. LedEventColor2

Refer to **3.1.6. LedEventColorBase**.

```
struct LedEventColor2
{
        LedEventColorBase       ledEventColor1;
        LedEventColorBase       ledEventColor2;
};
```

3.2.19. LedModeDefaultColor

Refer to **3.1.4. LedModeColorBase**.
The data set by **LedModeColorBase** is memorized in flash memory. When you start drone, it comes as a default value.

```
struct LedModeDefaultColor
```

```
{
        LedModeColorBase        ledModeColor;
};
```

3.2.20. LedModeDefaultColor2

Refer to **3.1.4. LedModeColorBase**.

```
struct LedModeDefaultColor2
{
        LedModeColorBase        ledModeColor1;
        LedModeColorBase        ledModeColor2;
};
```

3.2.21. Address

CODRONE's MAC Address.

```
struct Address
{
        u8              address[6];
};
```

3.2.22. State

```
struct State
{
        u8              modePetrone;        ///< CoDrone mode

        u8              modeVehicle;        ///< movement mode
        u8              modeFlight;         ///< flight mode
        u8              modeDrive;          ///< drive mode

        u8              sensorOrientation;  ///< sensor orientation
        u8              coordinate;         ///< coordinate
        u8              battery;            ///< battery check (0 ~ 100)
};
```

3.2.22.1. ModePetrone

Refer to **3.1.1.2.1. ModePetrone**

3.2.22.2. ModeVehicle

```
enum ModeVehicle
{
        None = 0,

        Boot,                   ///< booting
        Wait,                   ///< wait for connection

        Ready,                  ///< ready to start

        Running,                ///< main course

        Update,                 ///< firmware update
        UpdateComplete,         ///<firmware update done

        Error,                  ///< error

        EndOfType
};
```

3.2.22.3. ModeFlight

```
enum ModeFlight
{
	None = 0,

	Ready,				///< ready to fly

	TakeOff,			///< take off
	Flight,				///< flight
	Flip,				///< flip
	Stop,				///< emergency stop
	Landing,			///< landing
	Reverse,			///< turtle turn

	Accident,			///< convert into ready mode
	Error,				///< error

	EndOfType
};
```

3.2.22.4. ModeDrive

```
enum ModeDrive
{
	None = 0,

	Ready,				///< ready to drive

	Start,				///< start
	Drive,				///< drive
	Stop,				///< emergency stop

	Accident,			///< convert into ready mode
	Error,				///< error

	EndOfType
};
```

3.2.22.5. SensorOrientation

```
enum SensorOrientation
{
	None = 0,

	Normal,				///< OK
	ReverseStart,			///< start turtle turn
	Reverse,			///< finish

	EndOfType
};
```

3.2.22.6. Coordinate

Refer to **3.1.1.2.2. Coordinate**

3.2.22.7. battery

The range is 0~100.

3.2.23. Attitude

CODRONE's attitude angles(degree)

```
	Struct Attitude
```

```
{
        s16             roll;
        s16             pitch;
        s16             yaw;
};
```

<angle data(degree)>

Name	Type	Range	Note
roll	s16	-180 ~ 180	tilting angle of left/right
pitch	s16	-180 ~ 180	tilting angle of front/rear
yaw	s16	0 ~ 360	Heading angle

<raw data>

Name	Type	Range	Note
roll	s16	-32768 ~ 32767	slope value of left/right
pitch	s16	-32768 ~ 32767	slope value of front/rear
yaw	s16	-32768 ~ 32767	Heading value

3.2.24. GyroBias

Checking the gyro bias value. Refer to **3.2.23. Attitude**.

3.2.25. TrimAll

Fine adjustment

```
struct TrimAll
{
        TrimFlight   flight;
        TrimDrive    drive;
};
```

3.2.26. TrimFlight

Fine adjustment in flight mode. The range is -100~100.

```
struct TrimFlight
{
        s16             roll;
        s16             pitch;
        s16             yaw;
        s16             throttle;
};
```

3.2.27. TrimDrive

Fine adjustment in drive mode. The range is -100~100.

```
struct TrimDrive
{
        s16             wheel;
};
```

3.2.28. IrMessage

```
struct IrMessage
{
	u8		direction;
	u32		irData;
};
```

3.2.28.1. Direction

IR receivers are in front and rear of CODRONE.

```
enum Direction
{
	None = 0,

	Left,
	Front,
	Right,
	Rear,

	EndOfType
};
```

3.2.28.2. irData

IR transfer data. The size is 4 byte.

3.2.29. ImuRawAndAngle

```
struct ImuRawAndAngle
{
	s16		accX;		///< raw data
	s16		accY;		///< raw data
	s16		accZ;		///< raw data
	s16		gyroRoll;	///< raw data
	s16		gyroPitch;	///< raw data
	s16		gyroYaw;	///< raw data
	s16		angleRoll;	///< angle(roll)
	s16		anglePitch;	///< angle(pitch)
	s16		angleYaw;	///< angle(yaw)
};
```

3.2.30. Pressure

```
struct Pressure
{
	s32		d1;
	s32		d2;
	s32		temperature;
	s32		pressure;
};
```

3.2.31. ImageFlow

```
struct ImageFlow
{
	s32		fVelocitySumX;
	s32		fVelocitySumY;
};
```

3.2.32. Button

```
struct Button
{
```

```
        u8          button;
};
```

3.2.33. Battery

```
struct Battery
{
        s16         v30;
        s16         v33;
        s16         gradient;
        s16         yIntercept;
        u8          flagBatteryCalibration;

        s32         batteryRaw;
        s8          batteryPercent;

        s16         voltage;
};
```

3.2.34. Motor

```
struct Motor
{
        MotorBase  motor[4];
};
```

3.2.35. Temperature

```
struct Temperature
{
        s32         imu;
        s32         pressure;
};
```