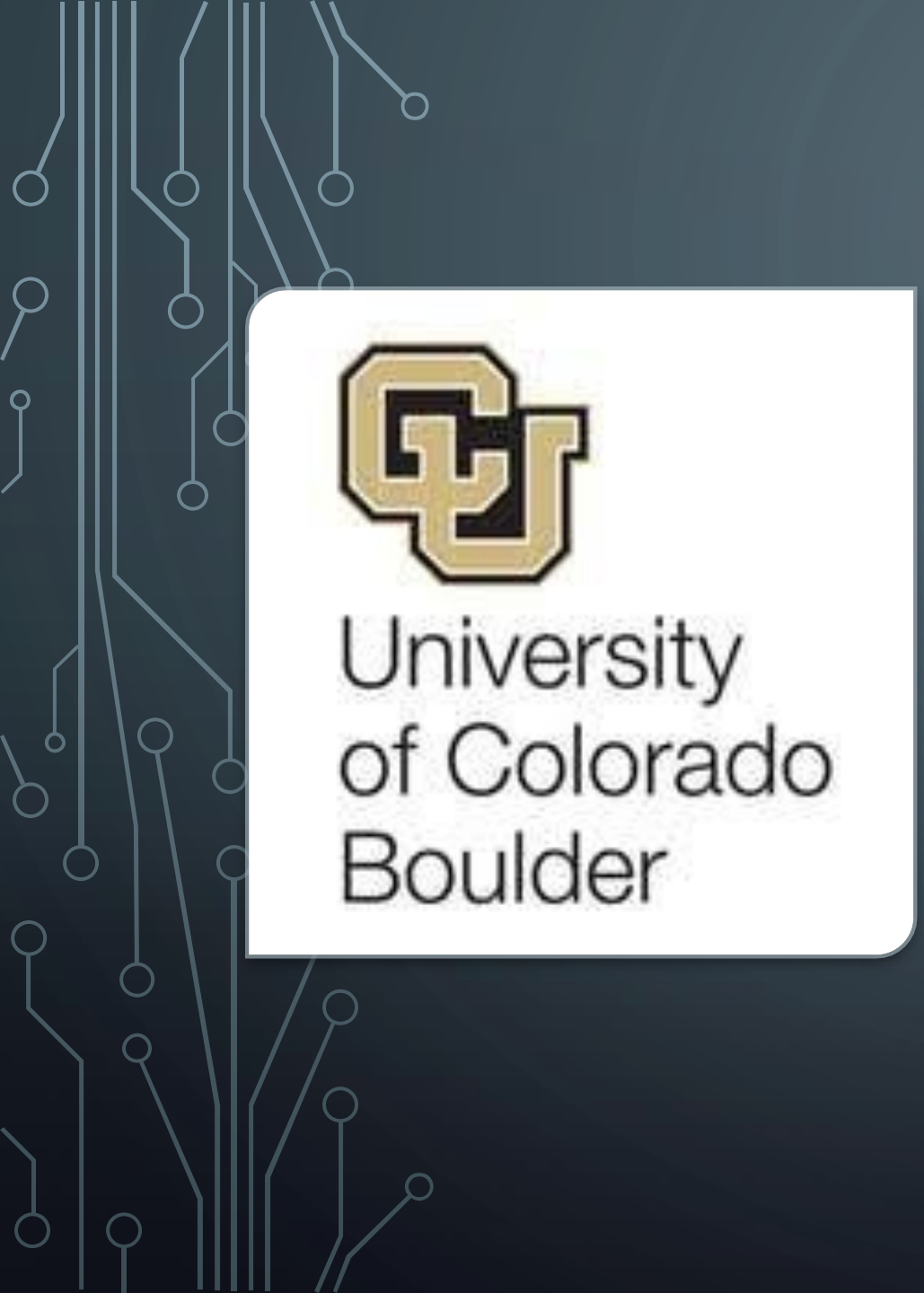


ECEN5013 - ADVANCE PRACTICAL EMBEDDED SOFTWARE PROJECT

GUNJ MANSETA

WHAT WILL I TALK ABOUT?

- PROJECT DESCRIPTION
- HARDWARE COMPONENTS
- SOFTWARE COMPONENTS
- MESSAGING STRUCTURE
- ARCHITECTURE DIAGRAM
- SOFTWARE WORKFLOW
- DEMO

PROJECT DESCRIPTION

- Proximity camera capture device
  - Captures image if the object found to be at a specific distance from the sensor
- The image frame captured, gets stored on the server – BeagleBoneGreen
- Remote Logging
- Remote Client – Connects to the BBG via sockets to get the sensor values, and close the server.
- Communication of the Client(TIVA) to Server(BBG) via compile-time swappable UART(tested) or RF
- Detailed Messaging structure to handle communication among multiple modules running on multiple boards

HARDWARE COMPONENTS

- TIVA C series TM4C1294XL development board running FreeRTOS
  - HC-SR04 Ultrasonic Sensor (GPIO and Timers)
  - Arducam OV2640 2MP camera module (SPI/GPIO/I2C)
  - NRF24L01(+) (SPI/GPIO)
- BeagleBone Green running Debian distro Linux
  - TMP102 temperature sensor (I2C)
  - APDS9301 luminosity sensor (I2C)
  - NRF24L01(+) (SPI/GPIO)

SOFTWARE COMPONENTS

- Tiva+FreeRTOS
  - Sensor tasks
  - Communication Module tasks – Comm recv, Comm Send, Dispatcher
  - Heartbeat timer
  - Camera Interface
  - Sonar Sensor interface
  - Driverlib
  - Messaging Queues, Task Notifications, and Mutexes

SOFTWARE COMPONENTS

- BBG+Linux
  - Sensor tasks
  - Communication Module tasks – Comm recv, Comm Send, Dispatcher
  - Heartbeat
  - Socket Server for remote access of on-board and Tiva sensor, and to close the application
  - Logging task
  - HW drivers
  - Messaging Queues, and Mutexes

MESSAGING STRUCTURE

```
COMM_MSG -
    SRC_ID src_id;
    SRC_BOARD_ID src_brd_id;
    DST_ID dst_id;
    DST_BOARD_ID dst_brd_id;
    MSG_ID msg_id;
    union custom_data {
        float distance_cm;
        float sensor_value; } data;
    char message[18];
    uint16_t checksum;
```

Transport Layer

Messaging Layer

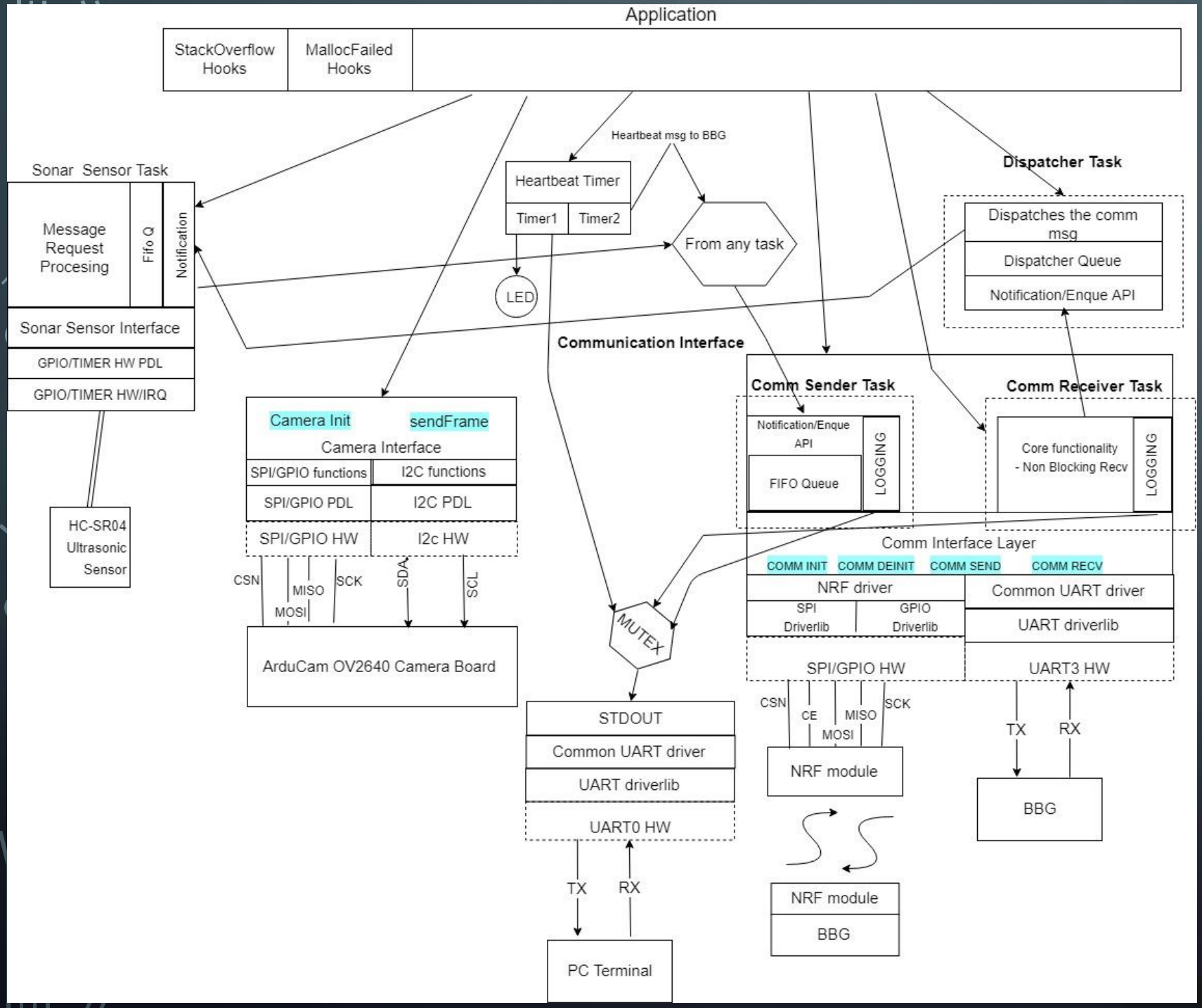
Message authentication

MESSAGING STRUCTURE

```
#define BBG_BOARD_ID          (0x00)
#define TIVA_BOARD1_ID        (0x01)
#define XYZ_TIVA_BOARD_ID     (0x02)

#define TIVA_HEART_BEAT_MODULE    (1)
#define TIVA_SENSOR_MODULE        (2)
#define TIVA_CAMERA_MODULE        (3)
#define TIVA_COMM_MODULE          (4)

#define BBG_LOGGER_MODULE         (1)
#define BBG_COMM_MODULE           (2)
#define BBG_SOCKET_MODULE         (3)
#define BBG_XYZ_MODULE            (4)
```

```
MSG ID:
    MSG_ID_HEARTBEAT = 0,
    MSG_ID_MSG,
    MSG_ID_SENSOR_STATUS,
    MSG_ID_ERROR,
    MSG_ID_SENSOR_INFO,
    MSG_ID_INFO,
    MSG_ID_PICTURE,
    MSG_ID_OBJECT_DETECTED,
    MSG_ID_CLIENT_INFO_BOARD_TYPE,
    MSG_ID_CLIENT_INFO_UID,
    MSG_ID_CLIENT_INFO_CODE_VERSION,

    //For BBG server
    MSG_ID_GET_SENSOR_STATUS,
    MSG_ID_GET_SENSOR_INFO,
    MSG_ID_GET_CLIENT_INFO_BOARD_TYPE,
    MSG_ID_GET_CLIENT_INFO_UID,
    MSG_ID_GET_CLIENT_INFO_CODE_VERSION,
```

ARCHITECTURE DIAGRAM



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