



University of Colorado
Boulder

PROJECT PROPOSAL

ADVANCED EMBEDDED SOFTWARE DEVELOPMENT

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SMART CART

GROUP MEMBERS:

OM RAHEJA

SORABH GANDHI

ARCHITECTURE AND DESIGN DOCUMENT

Sr. No.	Topic	Pg. No.
1.	Hardware Architecture and Design	3
2.	Remote Node	4
3.	Control Node	4
4.	Software Architecture and design	5
5.	Flowchart for Remote Node [TIVA C-SERIES LAUNCHPAD]	5
6.	Flowchart and Interaction Diagram for Control Node [BBG]	6

HARDWARE ARCHITECTURE AND DESIGN

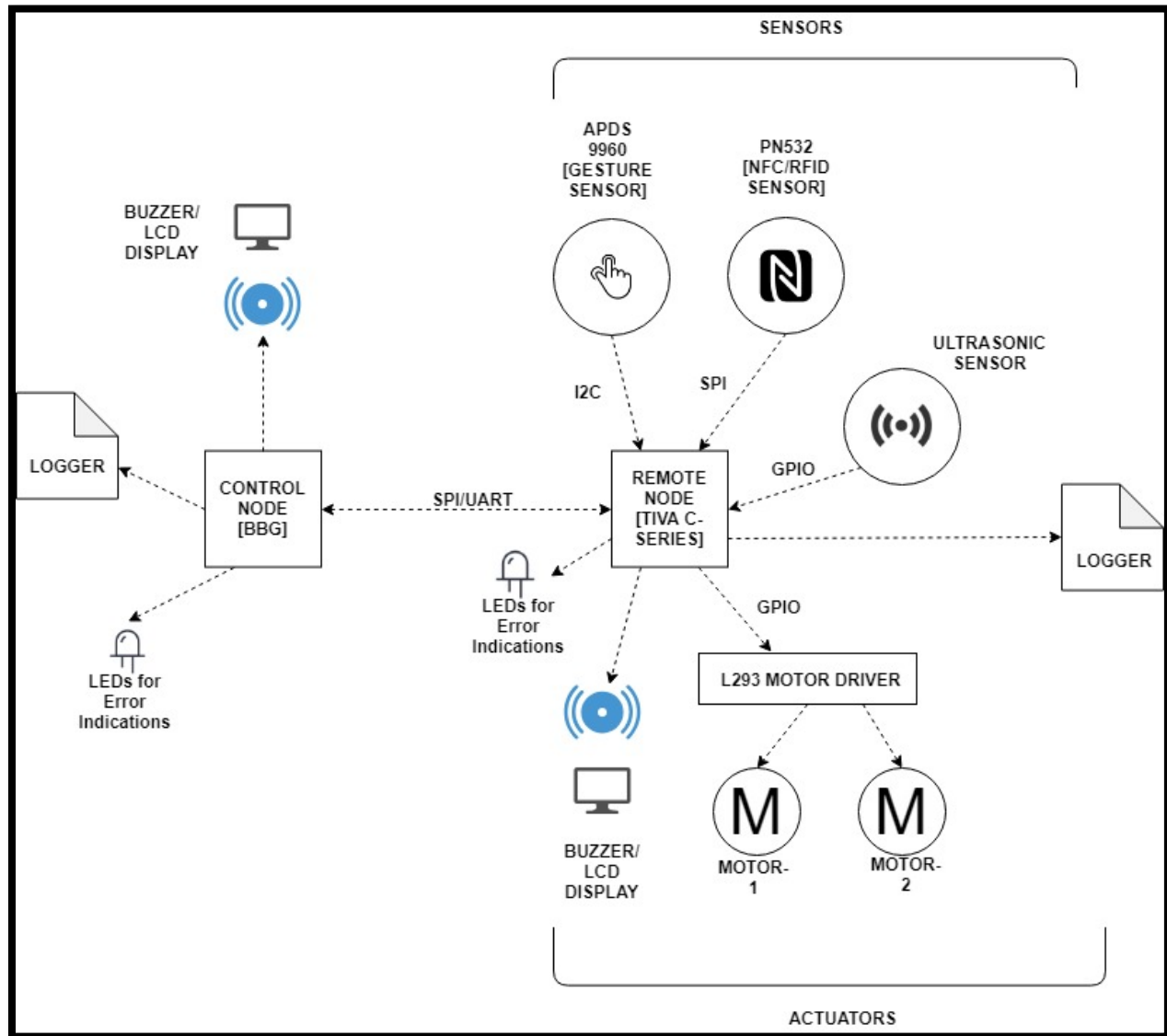


Figure.1

The Hardware architecture shows the overall application of the system. The design is majorly divided into two parts:

1. Control Node
2. Remote Node

REMOTE NODE

- The Remote Node shall comprise of the Tiva C-series LaunchPad board running a customized FreeRTOS image.
- The Remote Node shall consist of three sensors namely, Gesture sensor (APDS - 9960), NFC/RFID sensor (PN532) and the Ultrasonic sensor and three output devices/actuators, two of which will be motors and one will be either an LCD or a buzzer.
- The gesture sensor will be used to record the basic hand gestures (UP-DOWN-RIGHT-LEFT). Based on the recorded gesture, the motors on the cart will be driven.
- All the output devices will be triggered on the basis of a control signal sent by the control node.
- A display message will be displayed on the LCD on receiving a signal from the control node.
- LEDs will also be used to detect various instances in the system like Red LED for indicating errors like Communication down, Control node Inactive etc., detection of a dead sensor.
- In case of inactivity of the Control node, a Logger at the Remote node will be responsible for recording the events/errors/faults etc.

CONTROL NODE

- The Control node will comprise of a BeagleBone Green running a customized Linux image.
- The major task of this node is to receive all the sensor data from the three different sensors present at the Remote node and provide necessary and appropriate feedback to the Remote node which will eventually trigger the output devices based on the received feedback.
- Control Node will also be responsible to detect the mode of operation of the system. Based on the information from the Remote node, the Control node will determine whether the system is operating in normal mode, degraded mode or fail-safe mode. This will be indicated by either displaying it on an LCD or by Red, Yellow and Green LEDs where in the Red LED will indicate that the system is operating in a fail-safe mode, the Yellow LED indicating operation in degraded mode and the Green LED indicating operation in Normal mode.
- The Control node will have a logger which will log all the operations happening in the system at both the ends (Control node end & Remote Node end). The Log file will contain all the information (Error Messages/Debug Messages/Information Messages/Mode Switch Information etc.).
- The Control Node will also have various LEDs to indicate if the Control Node is Up and running or if the Communication Link is down etc.

SOFTWARE ARCHITECTURE AND DESIGN

FLOWCHART FOR REMOTE NODE [TIVA C-SERIES LAUNCHPAD]

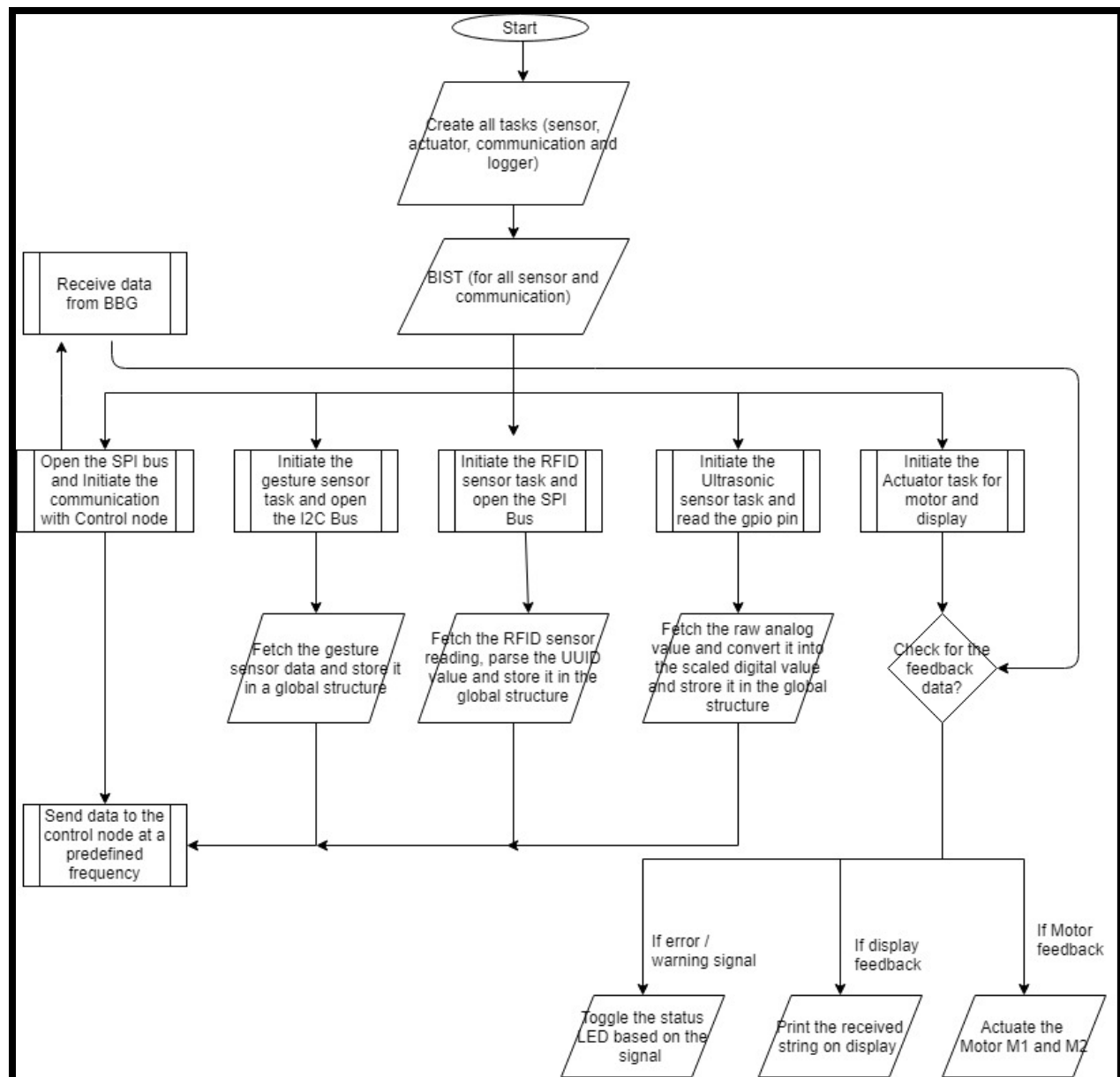
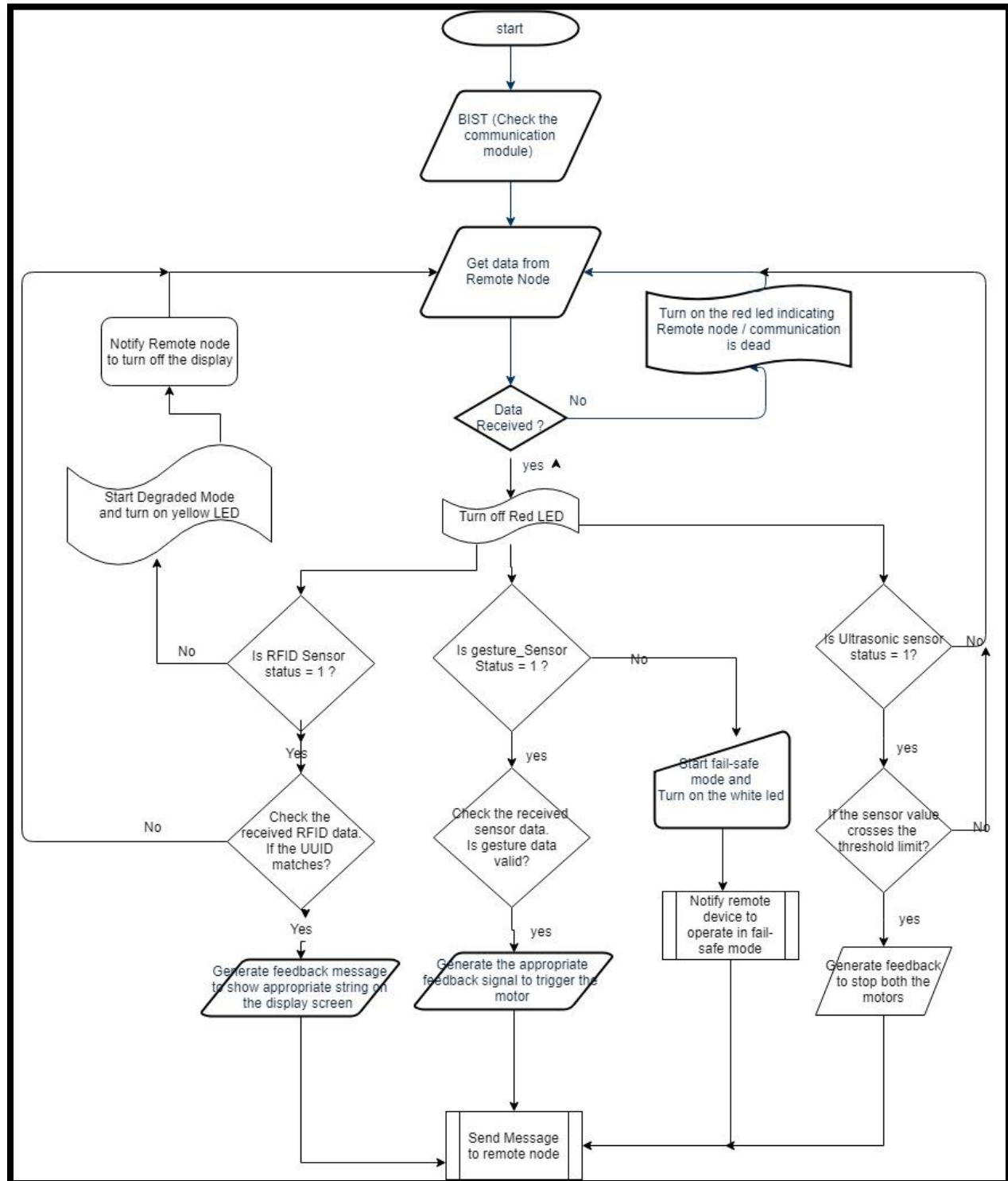


Figure.2

FLOWCHART AND INTERACTION DIAGRAM FOR CONTROL NODE [BBG]**Figure.3**

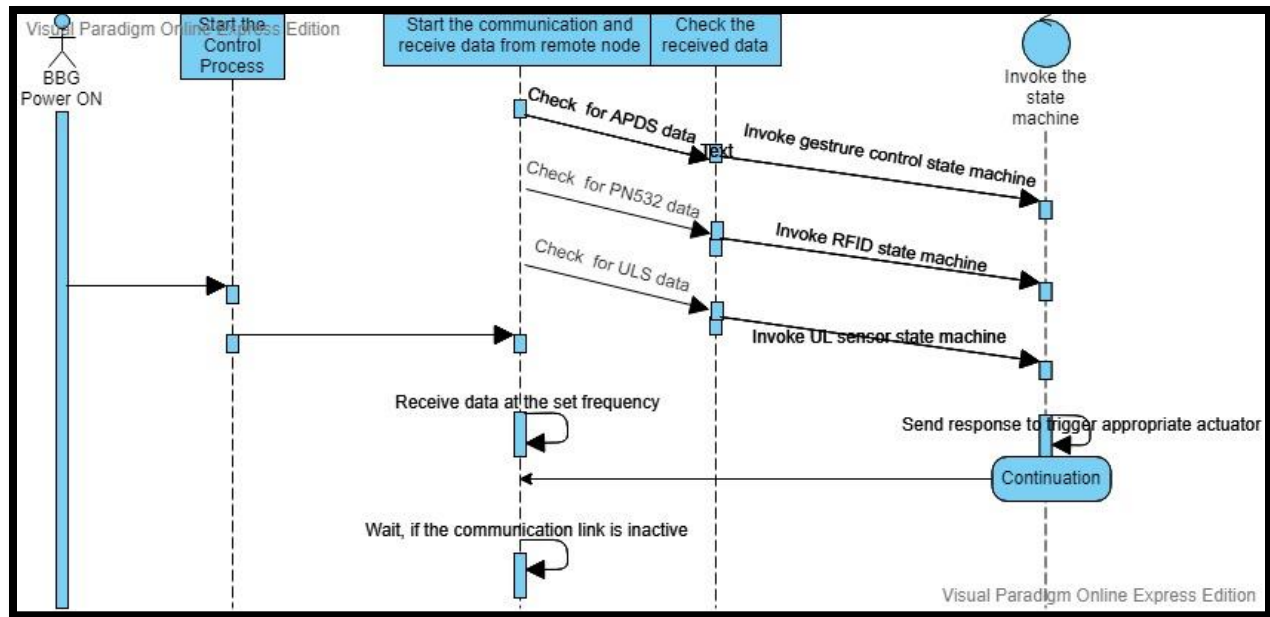


Figure.4