

**Project Design Phase-II**  
**Solution Requirements (Functional & Non-functional)**

|               |                                                              |
|---------------|--------------------------------------------------------------|
| Date          | 12 October 2022                                              |
| Team ID       | PNT2022TMID39755                                             |
| Project Name  | <b>Smart Waste Management System for Metropolitan Cities</b> |
| Maximum Marks | 4 Marks                                                      |

**Functional Requirements:**

| FR No. | Functional Requirement (Epic)        | Sub Requirement (Story / Sub-Task)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FR-1   | Fitting IoT device in the trashcans. | The IoT device need to be fixed in the dustbin with water proof safety. The IoT device consists Ultrasonic sensor, IR sensor, Weight sensor. To send data to the cloud GSM/GPRS is used.                                                                                                                                                                                                                                                                                                                                                           |
| FR-2   | Connecting to the cloud.             | The device should configure to connect to the cloud. The data of sensors need to be received and processed.                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| FR-3   | Predictions for bin fulness.         | In this system, a 24×7 monitoring system is designed for monitoring dumpsters, A smart and organized system is designed for selective clearing the ultrasonic sensor is used for measuring the level of waste in the dustbin, DC motor powered platform is used for segregating wet and dry waste, IR sensor and moisture sensor is used for separating wet and dry waste. If either of the containers is full then an alert message is sent from the dustbin to employees and the cloud. In turn, employees can clear the corresponding dumpster. |
| FR-4   | Real-time waste monitoring           | Trash and recycling containers can be outfitted or produced with low-cost sensors that monitor everything from the amount and types of material in a container to temperature, odour and location of the bin.                                                                                                                                                                                                                                                                                                                                      |
| FR-5   | Do not miss a pick                   | For periodically picked bins, we provide Pick evaluation. The tool records picks (sensor) and compares them to the schedule. Authorized person can immediately identify any missed, or off-schedule picks.                                                                                                                                                                                                                                                                                                                                         |
| FR-6   | Routes to the dumpsters              | Based on current bin fill-levels and predictions of reaching full capacity, you are ready to respond and schedule waste collection. driver can compare planned vs. executed routes to identify any inconsistencies.                                                                                                                                                                                                                                                                                                                                |

**Non-functional Requirements:**

| <b>FR No.</b> | <b>Non-Functional Requirement</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NFR-1         | <b>Usability</b>                  | IoT solutions for waste management problems offer municipalities data intelligence and real-time insights. In that regard, the fill patterns of specific containers can be identified by historical data and managed accordingly in the long term. In addition to hardware solutions, mobile applications are used to overcome the challenges in the regular waste management system, such as keeping track of the drivers while they are operating on the field. |
| NFR-2         | <b>Security</b>                   | Building and deploying IoT-based smart waste management in cities can be a complex, time-consuming and resource-intensive process. Many municipal IT departments will not have the resources or in-house skills to support such a project internally.                                                                                                                                                                                                             |
| NFR-3         | <b>Reliability</b>                | One of the difficult operational problems of municipal and local authorities are facing is the collection of municipal solid waste. In recent years, due to environmental concerns and number of costs, most of the municipalities have been forced for assessing their solid waste management and examining their cost-effectiveness and environmental impact, for example, designing the collection of routes. During the past 15 years                         |
| NFR-4         | <b>Performance</b>                | An integrated Arduino program is developed to synchronize the identification system, automated lid system, micro-controller, display system, and communication system. An ultrasonic sensor is attached to the front side of the garbage bin. The transmitter of the ultrasonic sensor emits an ultrasonic sound that is beyond the human ear listening range, and the receiver receives the reflected sound waves by the solid objects.                          |
| NFR-5         | <b>Availability</b>               | Another purpose of this project is to make the proposed waste management system as cheap as possible. A cost in BDT is presented in the following Table 3 needs for the construction of the proposed smart bin.                                                                                                                                                                                                                                                   |

|       |                    |                                                                                                                                                                                                     |
|-------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NFR-6 | <b>Scalability</b> | The city diverts about 80% of its waste from landfills and hopes to go “zero waste” by the end of 2020. Besides strict regulations and high waste management fees for end consumers and businesses. |
|-------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|