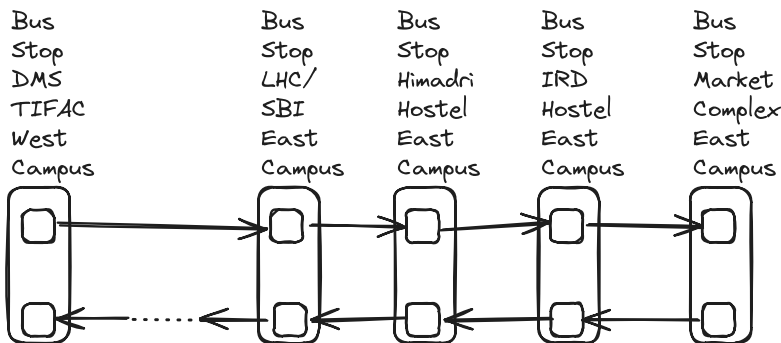# Project P2 NEXTBUS 13 Mar 2024

# 1 Problem Statement



A campus has a bus service to carry residents within campus.

The number of buses can be from 0 to k (presently there are TWO buses, so k=2).

There are two endpoints ( East Campus Market and DMS TIFAC Building).

The buses do not display their labels and users wait in the appropriate bus stop on the correct side of the street and take the next bus travelling in the direction they want to go.

When there is more than one bus available, each bus starts with staggered starting time.

Travel times between stops is approximate and may vary by at most 1 minute.

The *k* buses could be said to be running in a circular route because they turn around at the end points and run back over the same roads.

Their bus stops are roughly (not exactly) on opposite sides of the road and denoted by a steel pole with the picture of a bus or a cement pole with a embossed inverted triangle.

At the end points, a bus waits for 5 minutes before starting back again (it never starts earlier than a designated starting time).

## 1.1 Need

Waiting users need to know when the next bus is expected (in minutes) so that they decide to wait for the bus or choose an alternative (walk / ask for a

lift etc)

## 1.1.1 The Display Unit at every Stop

A display unit must be installed in every bus stop to display the following messages alternately in English and Hindi:

> '*The next bus is due in ......... minutes*'
> *अगली बस ........ मिनट में आने वाली है।*

1. Readability
    1. The italicized portion of the display may be pre-printed with only the actual time displayed in flashing/blinking mode (suggested display is on 7-segment displays and read from 0...999)
       LCD displays with yellow backlighting are welcome.
    2. The display must be readable from any point by a person with 6/6 vision standing at upto 8 feet in front of the bus stop.
    3. The reading on the display must be accurate to $\pm 1$ minute.
2. The Bus Stop unit has a white downward pointing LED which blinks with a 30% duty cycle during normal service.
3. Connectivity
    1. Cellular connectivity like GSM and even WiFi is not preferred if their non-availability causes the system to stop working.
        1. Occasional use of WiFi (IITD WiFi) is allowed - for instance to obtain a IP address if needed, or for a OTA update.
    2. The use of Bluetooth BLE is allowed in BUk and the Display Units.
    3. Any form of connectivity (wireless or wireless) which is legally allowed in India is allowed.
4. Power
    1. The display unit in the stop must be battery powered and must work between 0700 to 1930 hours.

2. Outside these hours, it must self-power down and auto-restart the next day.

3. Solar power must be provided as an option.

   Bus stops are usually located in the shade (for human comfort) so the solar panel must be installed from the nearest sunny point.
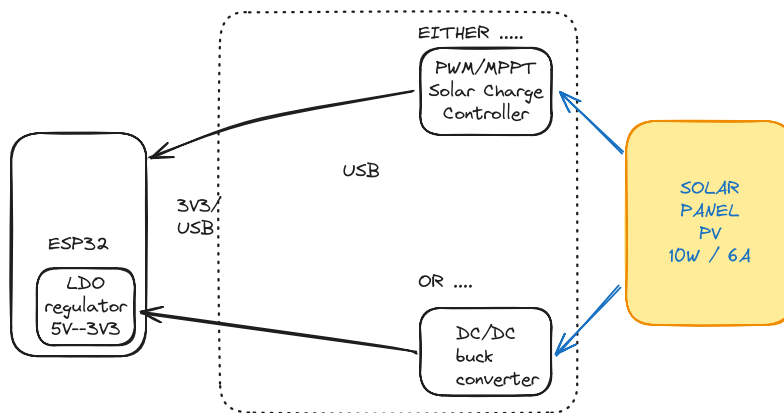


5. Waiting User input

   1. The presence of a waiting passenger standing for more than 0.5 minute in any stop may optionally trigger a detector, and be used to inform (the single bicolor LED in the BUk starts blinking) the bus unit BUk that passengers are waiting.

6. The Display Unit is exposed to all Delhi weather conditions.

   IP67 enclosures are to be used and will be provided by the lab.

   *Four* enclosures per Tribe for the DU unit will be provided -- two to be used for the Route 1 bus stops and two for the other Route 2.

## 1.1.2 Bus Mounted Unit

Each bus may have a unit (BUk for the $k_{th}$ bus) .
The BUk has one bi-colour LED (red/green).

- RED = Bus is Out of Service (every stop on that route will display a suitable Warning for the waiting passengers)
- RED+BLINKING = free / Available for design if any error condition to be flagged
- GREEN = Normal Service

- GREEN + BLINKING = Passengers are waiting in any of the Bus Stops on the route
- WHITE LED : The lab will make one WHITE LED available to you, please use it for a design purpose which is meaningful.
The BUk is powered from the battery of the bus (primary power) and from a separate internal battery (secondary power).
Primary power is available whenever the ignition is on or the when the engine has started.
Secondary power is on at all remaining times.
Switchover from primary to secondary power is automatic and without human intervention.
A BUk cannot be turned off.

The BUk has a RED toggle switch with positions 1 and 2 - pressing it to position 1 means that the 'BUS IS OUT OF SERVICE'.

## 1.2 Procurement

The following will be procured in the week ending 21 Mar 2024:

1. Enclosures for BUk and DUk
2. Solar panels (10W/6A)
3. DC-DC buck converters (12V stepped down to 3.3V)
4. PWM Solar Charge Converters (details posted in channel)
5. USB cables
6. ESP32 S-series

## 1.3 Logging and Maintenance

The service is under the Transport Section which needs to know the following data on a daily basis.

1. When the bus runs and does not run ?
(A bus which is often not available may be replaced by a new one)

2. What was the run time between two stations ?

3. What is the mileage ?

4. Waiting time at stops ?

5. Which stop has how many passengers ?

   This is inferred indirectly from the time the bus stops to board/de-board passengers.

   More passengers means the more boarding time.