User Manual

COMP2121 Project

A Monorail Emulator

# Board setup

A circuit board

Description automatically generated

|  |  |
| --- | --- |
| Devices | Pins |
| LCD | PF0 – PF7 => D0 – D7  PE5 => BL  PA4 => BE  PA5 => RW  PA6 => E  PA7 => RS |
| PB0 & PB1 | RDX3 => PB1  PDX4 => PB0 |
| MOTOR | PE2 – Mot  TDX2 – OpO  PA3 – LED  +5V – OpE |
| LED | PC0 – PC7 => LED2 – LED9  PG2 – PG3 => LED0 – LED1 |
| KEYPAD | PL0 – PL3 => C3 – C0  PL4 – PL7 => R3 – R0 |

# Operating instructions

## Step 1: Enter the number of stations

Initially, the LCD screen will display:

|  |
| --- |
| Max station num: |
|  |

This step is to obtain the maximum number of stations that we will need. The maximum number of stations is 10.

Here you will need to press a key on the keypad. The keys 2-9 represents themselves and the key “A” represents 10. “0”, “1”, “B”, “C”, “D”, “\*” and “#” will not work if you press them. The following table demonstrates such information:

|  |  |  |
| --- | --- | --- |
| Buttons | Functions | Example output |
| “2” to “9” | Represents input of the number of stations corresponding to the input number | |  | | --- | | Max station num: | | 2\_ | |
| “A” | Represents input of the number of stations, 10 | |  | | --- | | Max station num: | | 10\_ | |

Once you have entered a correct input, you input value of max number of stations will be stored and you will go to the next step.

## Step 2: Enter the name of each stations

Initially, the LCD screen will display:

|  |
| --- |
| Name of s1: |
|  |

This step is to obtain the name of each station required. The names are consistent of letters and white spaces. The max number of character input is 10. Here the letters can be input through a combination of two keys. 00 to 26 represents the alphabet A to Z.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 |
|  | A | B | C | D | E | F | G | H | I | J | K | L |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

Note that keys “A”, “B”, “C”, “D” and “\*” will not work if you press them. After you finished entering the name of the first station, press “#” to store the value and you can enter the name of the second station, and so on. Once you have entered names of all stations, pressing “#” will lead you to the next step. The example input and output of the first and second characters is shown in the following tables:

### First Character

|  |  |  |
| --- | --- | --- |
| Buttons | Functions | Example Output |
| “00” | A space will be entered | |  | | --- | | Name of s1: | | \_ | |
| “01” | A will be entered | |  | | --- | | Name of s1: | | A\_ | |
| ⋮ | ⋮ | ⋮ |
| “25” | Y will be entered | |  | | --- | | Name of s1: | | Y\_ | |
| “26” | Z will be entered | |  | | --- | | Name of s1: | | Z\_ | |

### Second Character

Once you have entered the first character, the corresponding letter (or white space) will be displayed on the left side of the screen. Now it is time to input the second character. Here, we assume that letter “K” is entered for the first letter.

|  |  |  |
| --- | --- | --- |
| Buttons | Functions | Example Output |
| “00” | A space will be entered after K | |  | | --- | | Name of s1: | | K \_ | |
| “01” | A will be entered after K | |  | | --- | | Name of s1: | | KA\_ | |
| ⋮ | ⋮ | ⋮ |
| “25” | Y will be entered after K | |  | | --- | | Name of s1: | | KY\_ | |
| “26” | Z will be entered after K | |  | | --- | | Name of s1: | | KZ\_ | |

## Step 3 Enter the travel time from one station to another

The LCD screen will display as follow:

|  |
| --- |
| T(S1->S2): |
|  |

The step is to get the time for the monorail to travel from one station to the next without stopping, and the maximum time is 10 seconds. In this step “0”, “1”, “B”, “C”, “D”, “\*” and “#” will not work if you press them.

|  |  |  |
| --- | --- | --- |
| Buttons | Functions | Example output |
| “2” to “9” | Displays the time travelling between the two stations (in seconds) | |  | | --- | | T(S1->S2): | | 2\_ | |
| “A” | Displays the time travelling between the two stations (in seconds), A means represents 10 | |  | | --- | | T(S1->S2): | | 10\_ | |

Once you have pressed a number, the travel time will be stored, (T(S1->S2) means the time travelled for the trip from station 1 to station 2) and you will be entering the travel time for the next trip. For example, once you have finished entering travel time for T(S1->S2), you will be entering travel time for T(S2->S3). You will only go to the next step if the travel time for all the trips are entered. For example, if you have three stations, the sequence of input request will be T(S1->S2), T(S2->S3) and T(S3->S1).

## Step 4: Enter the stop time

Initially, the LCD screen will display:

|  |
| --- |
| Stop time: |
|  |

This step records the stop time of the monorail at all stations. You can input any from 2 to 5 by pressing on the keypad. (As these are the boundary values for the stop time) All other keys do not work if you press them.

Step 5: Wait for the configuration to complete

The LCD screen will display:

|  |
| --- |
| Please wait for a moment |
|  |

After 5 seconds, the motor will start spinning. It will emulate the behaviour of the monorail. It spins at a speed of 60 rps when the monorail is travelling. If the monorail stops, the motor will stop. The screen will display the name of the next station at all times when the monorail is travelling. (motor is spinning) Whenever the monorail stops, 2 LEDs blink at a frequency of 3 Hz (3 blinks per second). Otherwise, when the monorail is travelling, the 2 LEDs switch off.

You can use PB0 and PB1 to simulate if the tourist wants to get off and a tourist wants to get on at the next station. If PB0 is pressed, it indicates that a tourist wants to get off at the next station. If PB1 is pressed, it indicates that a tourist wants to get on at the next station.

You can press # key to stop the moving monorail immediately, if # is pressed again, the monorail will continue to travel.