Arab Academy for Science, Technology
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RoBust

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1. Summary

GPS-enabled software systems combined with hardware like a tracking device installed within buses as well as apps installed on the phones of users (e.g., drivers), a "real-time" bus tracking system can monitor the movement of buses on a map. Data such as the speed of the bus, the distance covered, the remaining distance to its destination, and the number of scheduled stops is received by Fleet managers in real-time. This helps them take corrective action should there be any deviations or delays. An essential part of bus tracking is the college-bus segment since it is greatly beneficial for college authorities to monitor their students' safe transit.

2. Introduction

A "real-time bus tracking system" tracks the movement and locations of buses traveling along various routes at different times and provides live data in "real-time" to a central control room. This helps Fleet Managers in the central location to monitor the progress of the buses i.e., whether they are traveling on pre-assigned routes, maintaining projected times, adhering to safety protocol while driving, making the prescribed number of stops (etc.). Unfortunately, deviation from the planned routes and timelines are often necessitated due to issues like sudden traffic jams and inclement weather – these often cause delays and need buses to be re-routed. When such deviations occur – e.g., when a bus either breaches the route prescribed, or its geofencing parameters or is taking longer than expected – the system alerts the Fleet Managers, who can take the required corrective actions in a prompt manner. Quite naturally, such a system is most helpful in tracking college buses since it helps college authorities monitor the movements of their students. They can track whether the bus has left, or reached, the school premises and when it will arrive if their students have boarded the bus, alighted per schedule (etc.). This helps both, college staff, to organize their timings to manage the safe transit of the students daily. Such a system is integrated across its various users (stakeholders) right from the centralized control room (i.e. where the Fleet Managers or college authorities are located) to the bus itself (via an embedded/installed tracking device), as well as the driver (via an App on his phone). Additionally, the buses can also be installed with a scanner (a hardware device) that can scan (e.g. via NFC) those that are boarding and alighting the bus e.g. employees, students, and college staff, and record the relevant details as required. This system of real-time tracking and the transparency – or, visibility- that it provides Fleet Managers helps them across several aspects of managing all the buses in their network.

3. User Manual

- ○ User as a student:
    - i. Enters the web application (Frontend).
    - ii. Requests a bus trip in a certain time and route.
    - iii. See the bus location that the student is registered in.
    - iv. See bus time departure and estimated arrival time.
- ○ User as a driver:
    - i. Enters the web application (Frontend).
    - ii. See the bus route assigned to him.
- ○ User as an admin:
    - i. Enters the web application (Frontend).
    - ii. Add or delete a trip .
    - iii. Add drivers credentials to a certain route.
    - iv. Set bus departure time.
    - v. Set bus stops.
    - vi. See students request and can accept/deny request for this route/time.

4. Bill of Materials

Description of components	Price
1 x Arduino UNO	240 EGP
1 x SIM808 Module	1350 EGP
Lithuim Batteries	300 EGP
LCD	300 EGP
Buttons	5 EGP
Total	2195 EGP

5. Stimulation and Schematic

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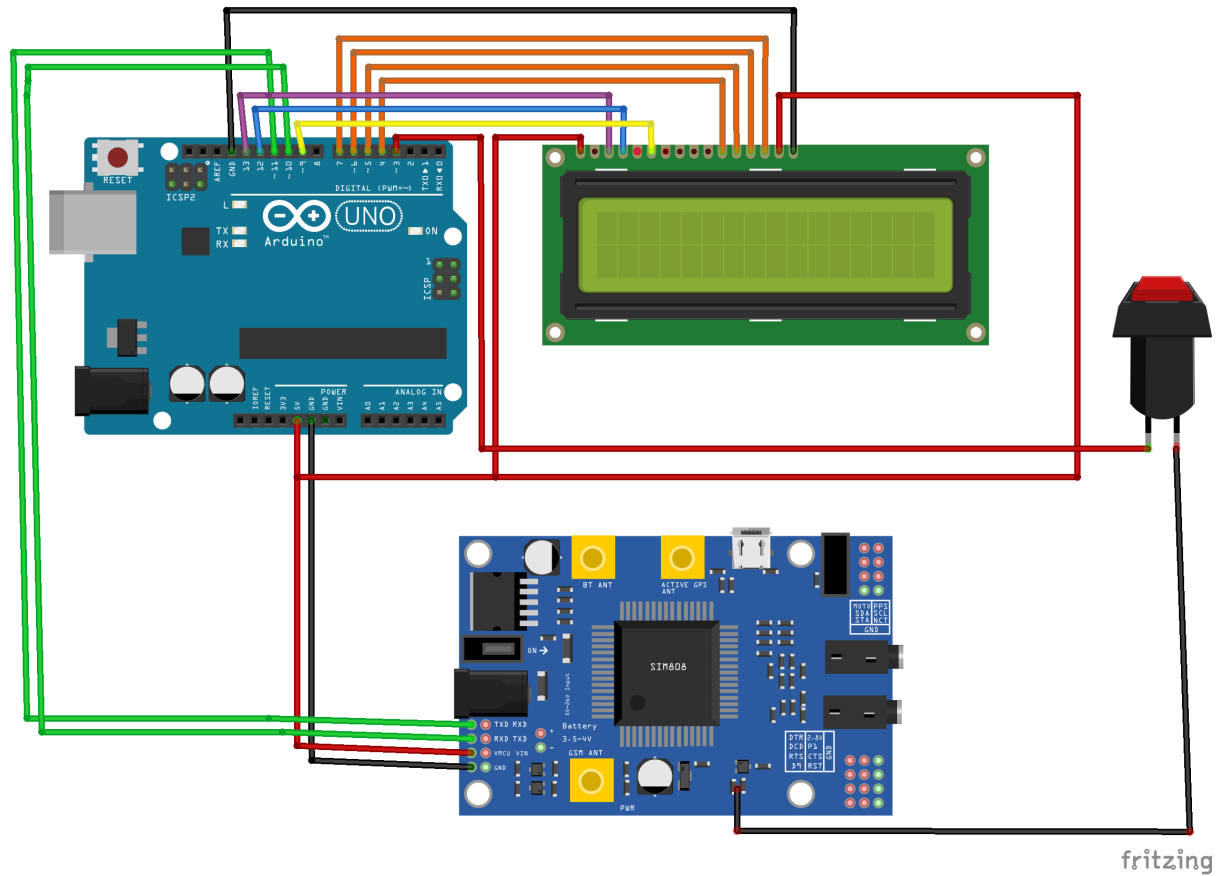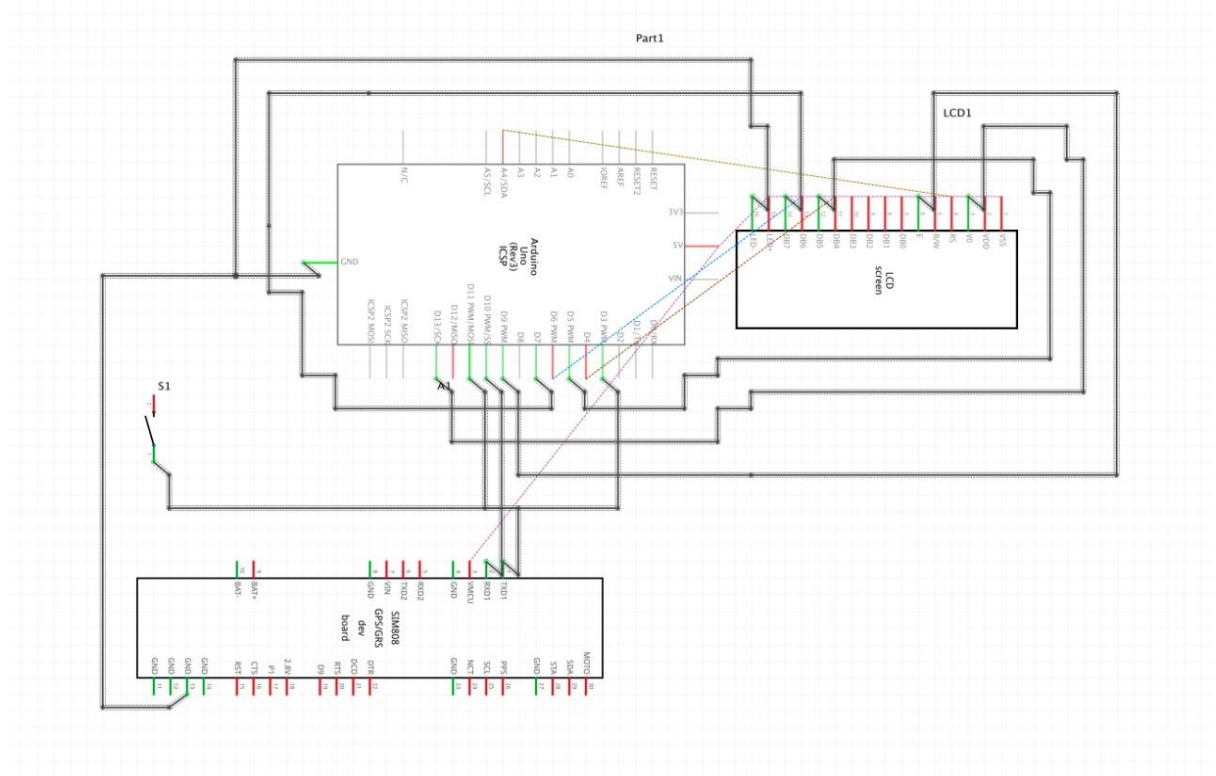
6. Background Literature Research

- We needed to study GPS/GSM modules to choose the suitable module.
- Searched about LCD usage.
- There was existing projects as our project "GPS and GSM Based Vehicle Tracking System" (see in resources).

7. Next Steps

- Implement NFC reader to authenticate students of bus routes.
- Implement the project in the AAST Bus System.
- Implement MQTT IOT Protocol to establish a communication between client and server.

8. Appendix

- https://github.com/NaNo211/RoBust
- https://www.researchgate.net/publication/334123684_GPS_and_GSM_Based_Vehicle_Tracking_System