A Project report on

NaviBus – Bus Tracking System

Submitted for partial fulfillment of Engineering Explorations Course
For Bachelor of Technology
Degree in

Computer Science and Engineering

For the academic year 2023-24
By,

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Title of the Domain: Intelligent Transportation System
Name of the Domain Lead: Veena S

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CERTIFICATE

This is to Certify that the project work "NaviBus – Bus Tracking System" carried out by Aniketh Bhargav (1RVU23CSE056), Akshata Athreya (1RVU23CSE035), Vishvesh K (1RVU23CSE543), Ahaan R (1RVU23CSE031), Tanisha Naik (1RVU23CSE500) and Kunal K (1RVU23CSE229) bonafide students of SoCSE in partial fulfillment of the Engineering Explorations course of Bachelor of Technology in Computer Science and Engineering of the RV, Bengaluru, during the academic year 2023-24. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in this report. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said course.

Title of the Domain: Intelligent Transportation System

Signature of the Domain Lead

Name of the Domain Lead:

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Acknowledgement

We gratefully acknowledge the help and support of each team member whose contributions have been vital in the successful completion of this project.

First, we take this opportunity to express our sincere gratitude to the School of Computer Science and Engineering, RV University, for providing us with a great opportunity to pursue our Bachelor's Degree in this institution.

In particular we would like to thank our Domain Lead, Prof. Veena S for her constant encouragement and expert advice.

It is a matter of immense pleasure to express our sincere thanks to Dr. Harsha B K, Course Lead EEx, for providing the right academic guidance that made our task possible.

We would like to thank one and all who directly or indirectly helped us in completing the project work successfully.

Abstract

The project aims to develop a simple bus tracking system that can be installed at bus stands in cities and rural areas. By utilizing GPS and microcontroller technology, real-time vehicle tracking will become possible, providing passengers with accurate information about bus locations and schedules. Despite infrastructure constraints, such as the need for GPS device installation and establishing reliable communication networks, the project endeavors to overcome these challenges to create a more efficient and accessible public transportation system.

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Introduction

Purpose of the Project:

The purpose of our project is to provide public with a more efficient BMTC transportation system. We have made the system very efficient to all people as it is cost efficient and gives access to tracking bus timings in both urban and rural areas. Our aim is to eliminate all the limitations or inefficiencies of public transportation system in the country that enhances the passenger's commuting experience.

Motivation for Taking this Project:

The awareness of the difficulties faced by the public while using BMTC transportation is our primary motivation to solve this issue. The most significant issue is the unreliable and unpredictable bus arrival timings. By using well developed GPS and microcontroller technology we have set a goal to eliminate any difficulties that the public faces by improving the mobility of millions of people through our project that revolutionizes public transportation management.

Scope:

Our aim is to come up with a user friendly model that is affordable to everyone and can be used in various areas including urban and rural bus stands. Development of this project involves steps like investing in infrastructure such as GPS devices for every bus and setting up a well functioning data transmission network. The code needs to be executed, packets need t o be received on the receiver end and the data needs to be converted into a human readable language.

Literature Surveys:

- Project Track My Bus Real time tracking of public buses using GSM communication
- https://circuitdigest.com/microcontroller-projects/lora-basedgps-tracker-using-arduino-andlora-shield

Work Done:

We conducted research on the project, acquired the necessary components, connected them to form our circuit, and developed C++ code for both the transmitter and receiver, modified it based on our circuit.

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Materials / Components Used

LoRa SX1278

Key Specifications:
The Lora RA02 module has a transceiver built in it, which does both transmitted and received modulated signals. The Lora module supports radio frequency at the front end. This module works in ISM bands such as 433MHz, 868MHz, 915MHz. It consists of multiple modes for the device that is transmit, receive and sleep mode.

Working Principles:
The Lora module works on the techniques of chirp spread spectrum to achieve long range communication.
Chirp spread spectrum is a mechanism that involves the transmitted signal getting converted in linearly modulating frequency overtime which in return makes long range communication possible.

Arduino uno

Key Specifications:
There are 14 digital input/output pins and 6 analogue input pins. It supports serial communication through universal asynchronous receiver transmitter, serial peripheral interface and inter-integrated interface, this allows communication with other devices.
Arduino uno can be powered in many ways-USB connection, external DC power supply or a battery. It has an internal oscillator providing a default clock frequency of 16MHz.
Arduino uno comes with a pre-installed bootloader

Working Principles:
Arduino uno is based on the AT-mega328P microcontroller. AT-mega328P contains all the external hardware like CPU, flash memory and SRAM. The Arduino Uno ATmega328 offers UART TTL-serial communication, and it is accessible on digital pins like TX (1) and RX (0). The software of an Arduino has a serial monitor that permits easy data. There are two LEDs on the board like RX & TX which will blink whenever data is being broadcasted through the USB.

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Neo GPS 6M

Key Specifications:

The GPS6MU2 utilizes signals from satellites to determine its precise location, velocity, and time. It has EEPROM to save configuration settings as well as rechargeable battery for backup. It is configurable from 4800 Baud to 115200 Baud rates under the supply voltage of 3.3V.

Working Principles:

GPS modules are used for asset tracking, wildlife tracking, and personal tracking devices. GPS technology provides high accuracy in determining location, often within a few meters. The u-blox 6 GPS module is designed to be compact, making it suitable for integration into various devices without taking up much space.

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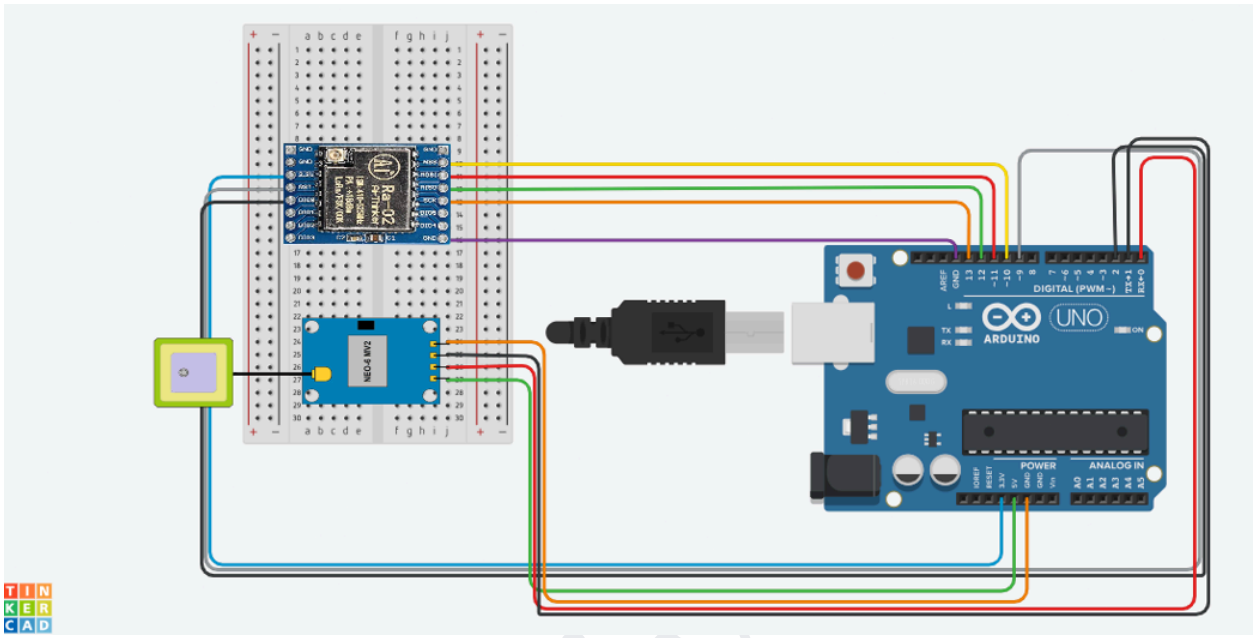
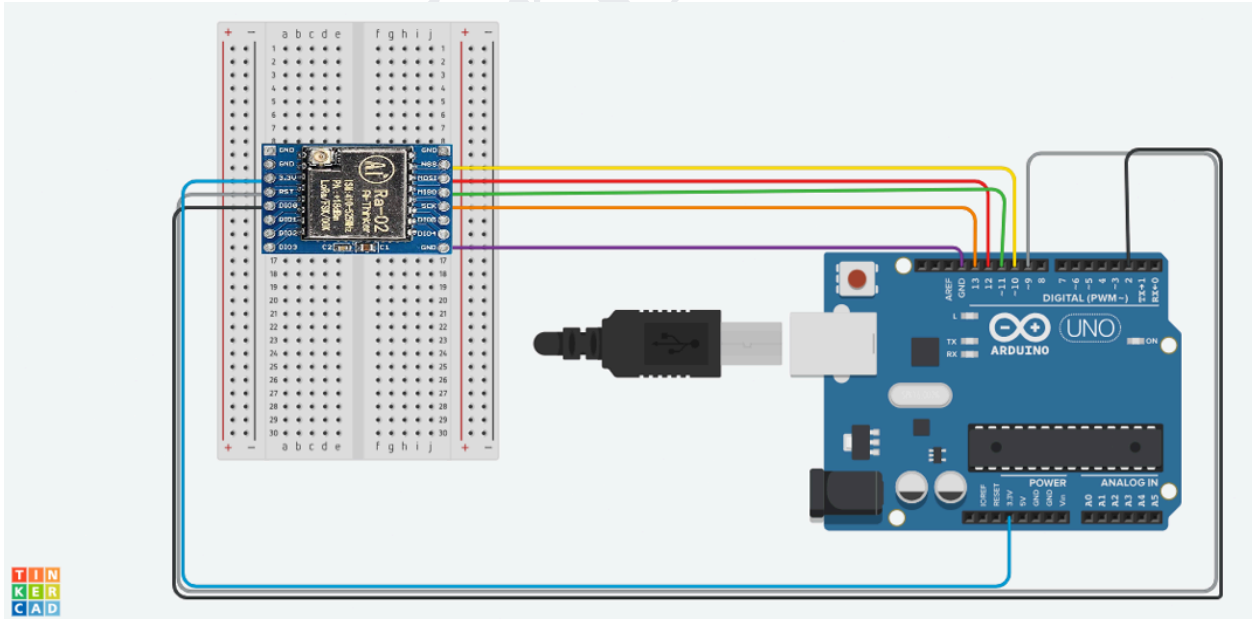
Circuit and Flowchart

Transmitter:



Receiver:



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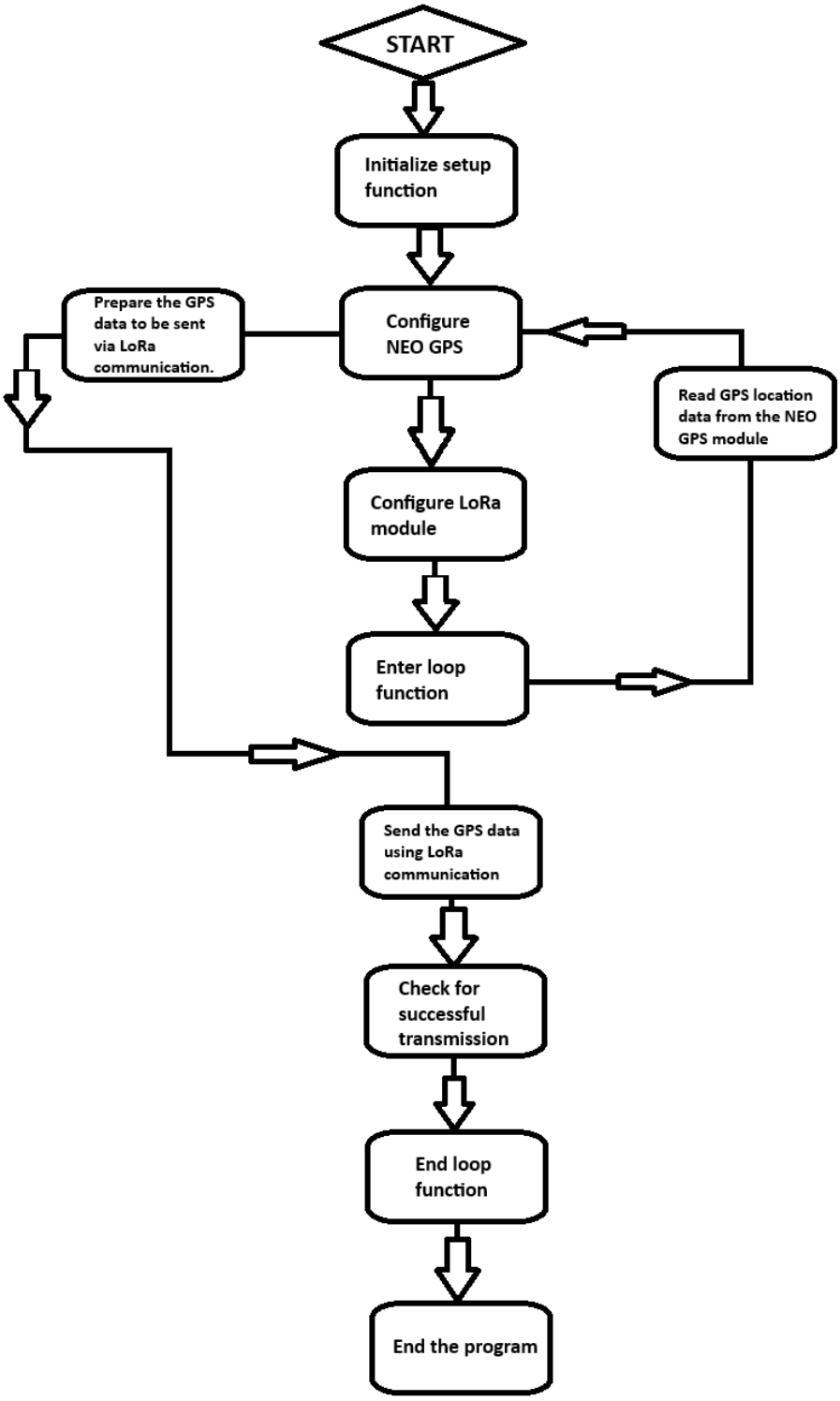

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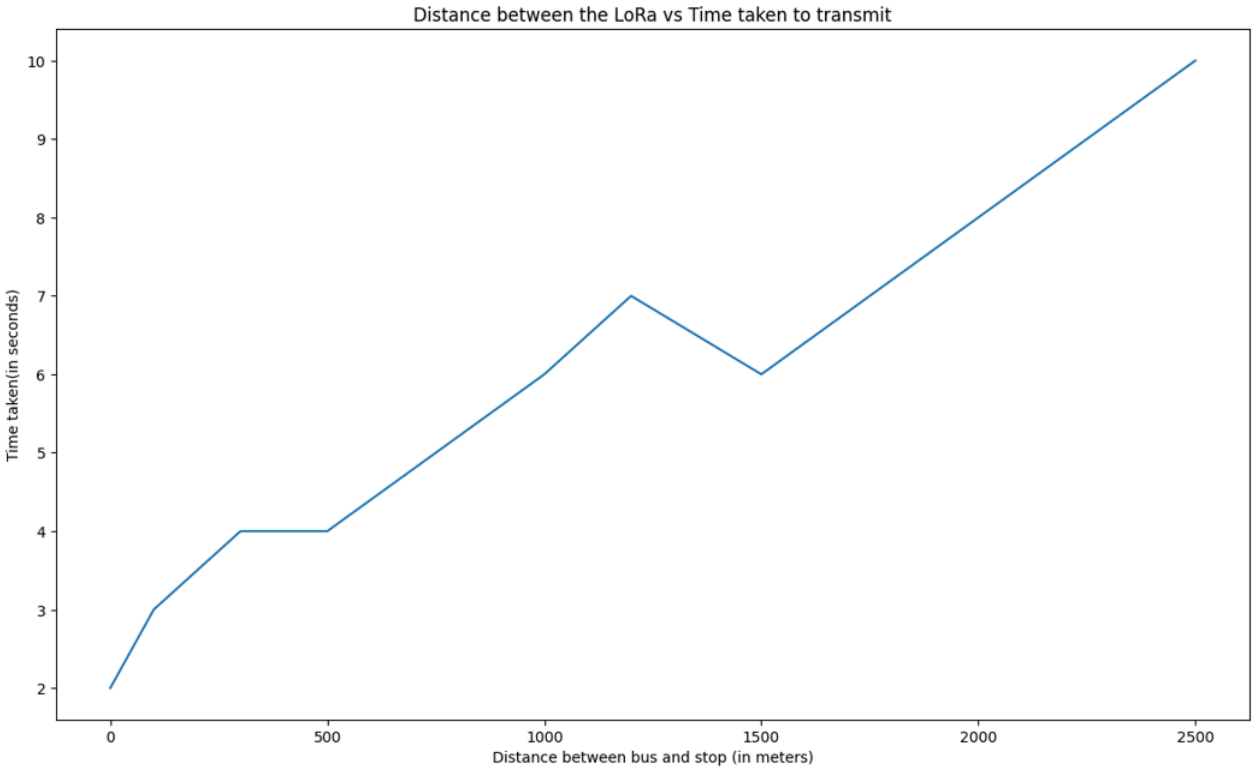
Data

Data such as gps coordinates, time, frequency at which the data is being transmitted is being collected from the buses. This information is transmitted to a receiver where it is updated every two seconds.
This data is stored along with the bus details and designated bus routes in a database.
This dataset enables real-time tracking and analysis of bus movements, leading to optimization in routes, improving service and overall transportation efficiency.

Inference from the data:

Comparing distance the LoRa transmits against time, we can see that there is a non linear relationship. The slight variation could be due to the change in transmission strength and quality, signal propagation, transmission range and due to traffic conditions.
This analysis provides valuable insights into the behaviour and performance in the real-world environment.

Visualization of data collected:



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Discussion / Conclusion

Problems encountered and solution:

Finding a LoRa module with our exact specifications was a problem we encountered. We instead used the Lora SX1278 module version.
Executing the code and receiving the packets on the receiver end and converting it into human-readable language.

The application of your prototype in various fields:

School Transportation: Parents can track the location of their children's school bus ensuring safety as well as security.
Tourism: One can get real-time updates on the location of tour buses and use interactive maps to improve their overall tourist experience.
Emergency Services: One can utilize bus tracking systems to coordinate during emergencies and natural disasters.

Future Work (Improvements):

Mobile App Enhancements:Improving the experience that a user gets on the mobile app by adding features like user authentication, personalized notifications and feedback facilities.
Localization:Supporting multiple language options on the application would be a significant way of localizing it and making it accessible to people in all kinds of regions.
Predictive Analysis: Using past data could help predict the bus arrival timings much accurately. Analyzing this data to predict the timings based on various factors like time , the day of the week, and different traffic patterns gives people an accurate timing of the arrival of any bus.
Monetization: Investing in revenue generating opportunities is an important step. This involves methods such as special paid features on the mobile app, establishing partnerships or allowing advertisements in the application.

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References

GitHub Link:
https://github.com/VK229198/Navi_Bus/

Video Link:
https://drive.google.com/drive/folders/1yEQeRjSy_5Sp-ONV5wKnzjSHyH2vqfVu?usp=drive_link

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