BUS TRACKING SYSTEM

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***Abstract*— Due to the increasing growth of the population, effective public transit infrastructure is required. Because of the population, public transit, such as buses, continues to be overburdened. As a result, a smart system is required that provides remote users with real-time bus information. As a result, we presented a new approach to address the shortcomings of public transit. Our system manages all of the information about the bus's current location, allowing for real-time bus tracking. This information is then sent to a remote user who wants to know the bus's current location. This project gives the location of local buses based on information sent by GPS modules, which the user/client can view via the cloud.**

Keywords - GPS - Global Positioning System; GPRS - General Packet Radio Service; CPU - Central Processing Unit; DC - Direct Current; VCC - Digital Power Supply; IEEE - Institute of Electrical and Electronics Engineering; MCU - Microcontroller Unit

INTRODUCTION

The public transportation system in the majority of Indian cities is inadequate. Passengers confront several issues, such as waiting for the bus at the bus terminal without knowing when it will arrive. They also have no idea where the bus is going. They also have no way of knowing how many seats are available in the vehicle for which they are waiting. It's also tough for management employees to administer the system over numerous routes. There is more traffic and passengers in the morning and evening than throughout the day. These issues must be managed by management personnel. When a specific vehicle fails, substitute vehicles for passengers and technical personnel for failed vehicles must be dispatched. Because this is a business, it is necessary to examine and make judgments in order to develop an effective system.

There are buses available to transport people to many areas, however, few passengers have comprehensive knowledge about these buses. Complete information, such as the number of buses that travel to the required destination, bus numbers, bus timings, the routes that the bus will travel, and the time it will take for the vehicle to arrive at its destination location, will assist passengers with various routes, track the current location of the bus, and provide the correct time for the bus to arrive at its destination. The suggested system is aimed at resolving the aforementioned issues. The system is an Android application that provides all of the relevant information on all of the buses that are now traveling. The platform chosen for this type of system is Android since the Android Operating System has risen in importance to the point that practically every second person owns one. Since its introduction, the Android operating system has seen an increase in the number of apps generated on a big scale.

EASE OF USE

The demand for public transportation is at an all-time high as the population grows. There were several occasions when we need real-time bus position information in order to arrange our destination and schedules. This project gives the position of local buses based on information supplied by GPS modules, which the user/client may access through the cloud. The first app that provides real-time bus location information. To make this product open-source and free. It's lightweight and simple to use. Make the gadget function and offer information even if there is no internet connection. The system is made up of both hardware and software components. The vehicle's hardware transmits the vehicle's current position to the cloud (Firestore in this project). The data from the cloud is then utilized to display real-time location information on a map on the mobile application (software).

LITERATURE SURVEY

In today's world, using technology in the sector of public transportation is innovative. As IoT technology advances, digital technology adds to existing objects and becomes more efficient and user-friendly. Older transportation management systems lacked live vehicle tracking, rendering management worthless. There were a lot of studies done on bus tracking systems. We were able to come up with a viable technique that makes it easier to implement the monitoring system for transportation by collecting diverse approaches from each survey or research. Many cities, like London, Berlin, New York, Hong Kong, and Japan, have already been innovators in the field of smart public transit. In India, smartness in transportation is still lacking. We can construct smart public transportation networks with the

rise of IoT technology. The emergence of digital vehicles, such as electric buses, has made it very simple to integrate different IoT-based technologies into them.

Existing systems and apps that help commuters plan their trips rely on mobile data for connectivity and communication, as well as GPS to determine the real-time location of the bus (or other modes of transportation) in relation to the commuter. In large cities, there are solutions that provide limited accuracy. These solutions, on the other hand, are not available in other places, and they rely on past data to deliver insight.

The system also includes a number of enhancements that make public transportation a more sophisticated and user-friendly system, allowing the general people to take full benefit of it. The technology was created specifically for Smart Cities, which are now popular. The primary concept for developing a smart public transportation system is to use an ARM system with GPS/GSM technologies. The primary motivation for developing this technology is to reduce public transportation-related time constraints. Vehicle tracking (online/offline), the number of seats available in the vehicle (bus), engine heat monitoring in the bus, women's safety, accident detection, and other functions will be integrated with the system.

COMPONENTS DESCRIPTION

GPS Tracking Unit

A GPS tracking unit is a device that uses the Global Positioning System to detect and monitor its precise location, and hence that of its carrier, at regular intervals. It is often carried by a moving vehicle or person. The recorded position data can be retained in the tracking device or sent to a central location database or an Internet-connected computer through a cellular (GPRS or SMS) modem, radio, or satellite modem included in the unit. This allows the position of the item to be shown against a map backdrop in real-time or afterward when using GPS tracking software to analyze the track. For cellphones equipped with GPS, data tracking software is available.

ESP - 32

ESP32 is a series of low-cost, low-power microcontrollers featuring built-in Wi-Fi and dual-mode Bluetooth. The Tensilica Xtensa LX6 microprocessor is used in both dual-core and single-core versions of the ESP32 series. It is the ESP8266 microcontroller's successor.

SIM800 Module

The SIM800L is a small cellular module that can send and receive GPRS data, send and receive SMS, and make and receive voice calls. This module's low cost, small footprint, and quad-band frequency capabilities make it ideal for any project requiring long-range communication. The power module starts up after being connected, looks for a cellular network, and logs in automatically.

TTGO T-Call Module

The Module is an ESP32-based development board with an inbuilt SIM800C 2G/GPRS module. The new board combines an ESP32 WiFi and Bluetooth WiSoC with a SIMCom SIM800C GPRS module, as well as a USB-C port for power and programming, rather than the more conventional micro USB port for this sort of gear.

This is the CPU for this hardware; it will be the vehicle unit's processing unit; it will take the position information from the GPS module, process it, and transmit it to the cloud.

1. The ESPRESSIF-ESP32 240MHz Xtensa dual-core 32-bit LX6 CPU is built within the wireless module.

2. It features a Type C interface and requires a 5V/1A power source.

3. It has Bluetooth v4.2BR/EDR and BLE standard protocol, as well as 802.11 b/g/n wifi protocol.

4. The cloud server and SDK for user firmware development are supported by the wireless communication module.

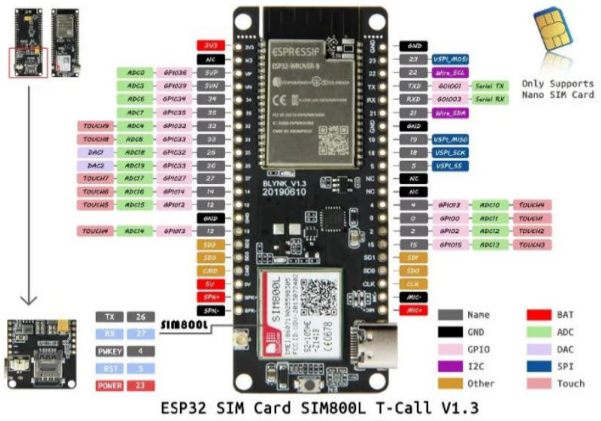

Fig 3.1 TTGO T Call Module Schematic Diagram

Neo 6m GPS Module

The Global Positioning System, or GPS, is a radio navigation system that allows land, marine, and aerial users to establish their precise location, velocity, and

time 24 hours a day, in all weather conditions, anywhere on the planet. A wide range of military, commercial, and consumer applications rely on GPS.

The NEO-6M GPS module is a high-performance full GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna for reliable satellite search. The power and signal indicators allow you to keep track of the module's status. The data backup battery allows the module to store data even if the main power is unintentionally turned off. Its 3mm mounting holes allow for simple installation on your aircraft, allowing it to fly consistently in a set place, return home automatically, and fly automated waypoints, among other things. You may even use it on your smart robot car to have it return or head to a certain location on its own, making it a true "smart" bot.

The GPS module records the data, which is subsequently processed by the TTGO T Call Microcontroller. The cloud receives the processed latitude and longitude data, which is then utilized in the mobile app to display the vehicle's real-time position.

SIMULATION

Because the ESP 32 module library is not available for the proteus simulation program, we utilized an Arduino UNO as the main controller for the simulation. We connected an Arduino UNO to a GPS and GSM module and examined the GPS module's output as well as the GSM module's functionality. The connections in the proteus were established as shown in the schematic, and the output was checked in the proteus terminal.

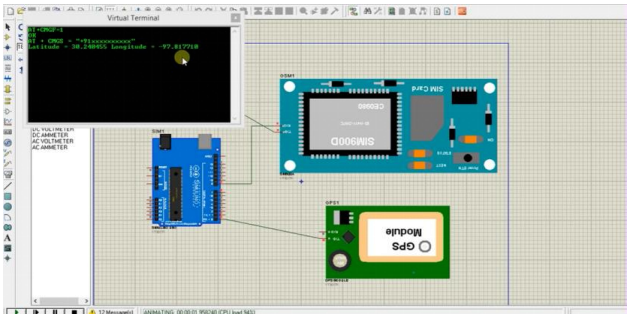

Fig 4.1 Simulation Output

SOFTWARE

Microcontroller

The Arduino code is used to program the TTGO T Call microcontroller to send the latitude and longitude info.

The basic operation of a unit is controlled by a TTGO T Call microcontroller, which is integrated within a system. It achieves it by utilizing its core CPU to analyze data from its GPS module. The microcontroller's temporary data is saved in its data memory, where the processor retrieves it and decodes and applies the incoming data using instructions stored in its program memory. It then communicates with its I/O peripherals and takes the required action.

Cloud Platform

This Cloud Firestore Server SDK authenticates with Google's Cloud Identity and Access Management and should only be used in secure situations. The Cloud Firestore Server SDKs are intended to manage the whole collection of data in a Cloud Firestore project and perform best when connected to a dependable network. The Cloud Firestore backend is directly accessed via these SDKs, and all document reads and writes are optimized for fast performance. Applications built with Google's Server SDKs should not be utilized in end-user contexts like phones or publicly accessible websites. The firebase Client SDK is used by applications that access Cloud Firestore on behalf of end-users.

The data from the GPS Module will be uploaded to the Firestore, where it will be constantly updated. The Firestore allows for a simple connection with Flutter, which can then be utilized in Flutter to update the map's position information.

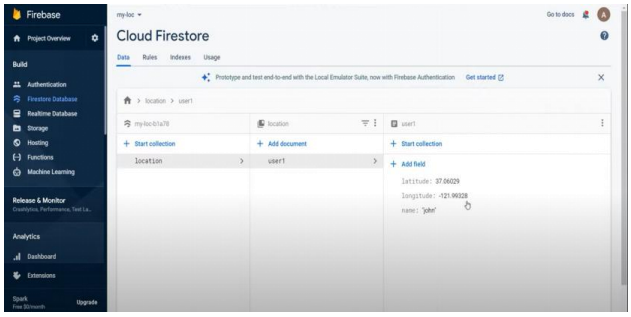

Fig 5.1 Firestore Data Document

Application Development

Google's maps SDK is used to display the map screen in the app. The Firestore's real-time location data (latitude and longitude) is fetched async and filled in the app using a marker, as seen in Figure 5.2. The software may also display the user's current location. Goggle's distance matrix API may be used to estimate the real-time distance and time between the current position and the destination using the aforementioned information.

Flutter is a Dart-based programming language. Flutter runs on the Dart virtual machine, which has a just-in-time execution engine when creating and debugging an application. This enables quick compilation times, as well as "hot, reload," which allows changes to source files to be injected into an already running program. Flutter takes this a step further by adding support for stateful hot reload, which ensures that changes to source

code are reflected in the current app without the need for a restart or any data loss.

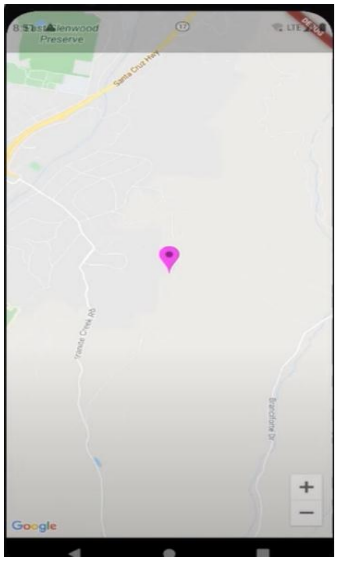

Fig 5.2 Moblie App Interface

CONCLUSION AND FUTURE SCOPE

With the aid of the ESP 32, TTGO T-Call Module, and GPS Module, the project "Bus Tracking System" is a model for a vehicle tracking unit. As a result of better fleet management, total productivity increased. Bus tracking, whether for personal or corporate needs, enhances safety and security, provides a communication channel, allows for performance monitoring, and boosts productivity. As a result, it will play a significant part in our daily lives in the future year.

A user may track their bus using the system's Android app. The tracking feature allows users to know how far the bus has traveled, allowing them to plan their itinerary and travel plans appropriately. The app will also provide an estimate of the bus's arrival time and distance. This will result in a shorter wait time, more readiness to pay, and higher customer satisfaction. This Android application will increase the efficiency of bus transportation.

The real-time speed, time, and expected arrival time between the source (passenger) and the destination (bus arriving at the bus stop) may be accomplished using Google's Distance Matrix API. The data from the bus department may be used to create a blueprint, and with that information, the feature can be better optimized because it only targets that specific spot (say a city).

We can identify car accidents with the use of extra sensors and send/call emergency services because we have GSM modules built-in. Using the location information provided by the bus driver/conductor can provide more accurate information. For example, Uber has a consumer app and a delivery person app. The delivering person app sends the location, which is then utilized to populate the information in the user app.

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