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Compact and Cost-Effective Object Tracking System Using Arduino Nano, SIM800L Module, and Multiplexer

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Abstract: In recent years location tracking systems have become increasingly popular in various fields including logistics transportation and personal security this research paper presents a cost-efficient and portable gadget that can locate missing items such as bags keys phones and other items the key finder device uses an arduino nano microcontroller board sim800l module buzzer and battery to track the objects position additionally the device emits a beeping sound and flashes when activated making it easy to locate missing items this project uses the arduino ide notepad php html php my-admin software to connect the device to a server through a post method the device is lightweight compact and easy-to-use design makes it suitable for personal tracking and security applications overall this research paper presents an innovative solution for locating lost items that could have significant practical applications in various industries

Keywords: Wireless Communication, Object Tracker, HTTP GET, Sim800l, Internet of Things (IOT), MYSQL, Server Response.

I. INTRODUCTION

Object tracking systems have become essential in many applications, including industrial automation, security systems, and logistics. This project aims to develop an object tracking system using a Sim800L module, Arduino Nano, and a Piezo buzzer. We have developed a compact and object tracker using on the Arduino nano microcontroller board ideal for personal tracking and security applications our. This project involves the development of software that can handle the data received from a MySQL server and communicate between a Webpage, a microcontroller and a Sim800L module. The Piezo buzzer is also integrated into the system for creating the final buzzer alerts hence tracking an object. Our project offers practical applications across various industries and could potentially enhance operational efficiency reduce losses and improve overall productivity in this research paper we present the design and implementation of our object tracker gadget and its potential uses in different scenarios. This project will provide insights into the development of an object tracking system using a Sim800L module, Arduino Nano, and a Piezo buzzer. The project will demonstrate the efficiency and effectiveness of using these components in object tracking systems and their potential to be used in various practical applications, as Key Finder, Mobile tracker, tracking numerous electronic gadgets.

II. LITERATURE REVIEW

There were different studies and research on Object Tracking System was done by the peoples for solving the problems faced by Users. The system tracks the patient's location and transmits it to a server using an Arduino Nano microcontroller, a GPS Neo6m sensor, and a GSM Sim800L module. The patient's location is then shown on a map by the server using the Google Maps API. The system is more adaptable, open and transparent, and less expensive to build and deploy than current commercial solutions, among other benefits. The proposed system is an important addition to the body of knowledge on IoT-based healthcare applications, and the paper is well-written and simple to understand [1]. The paper presents a method for detecting distant objects that makes use of an ultrasonic sensor (HC-SR04), a servo motor (SG90), a SIM808 module, an Arduino Uno, and a Raspberry Pi3. The ultrasonic sensor detects objects within a 3cm to 4m range, and the servo motor rotates the ultrasonic sensor 180 degrees. When an object is identified, the SIM808 module sends an SMS message to the administrator, and the Arduino Uno and Raspberry Pi3 process and display the data. The proposed system is a low-cost, adaptable, open-source solution for a wide range of applications [2]. The paper proposes a low-cost, customizable, and easy-to-use vehicle tracking system using a smartphone application and a microcontroller.

The system uses GPS and GSM/GPRS technology to track the vehicle's location and transmit it to a database. A smartphone application is used to display the vehicle's location on a map and to provide estimated distance and time to arrival at a given destination.

The paper provides a good overview of the proposed system and its advantages, but could be improved by including a more detailed evaluation [3]. In order to provide real-time location tracking and monitoring of vehicles, the system described in this paper uses a combination of GPS and GSM technologies. The system is intended to be used by transportation companies and other organisations to track their vehicles and enhance their operations. It is low-cost, simple to install and maintain, and scalable. The authors provide experimental data demonstrating the system's efficacy along with a detailed description of the system architecture and implementation [5].

This paper offers a thorough analysis of indoor positioning technologies for mobile devices, including WiFi-based, Bluetooth-based, magnetic field-based, and acoustic-based technologies. The authors compare each system's performance in terms of accuracy, dependability, and scalability, as well as its benefits and drawbacks. The challenges and potential directions for indoor positioning research are also covered in the paper [6]. This paper offers an overview of location-based services, such as social networking, advertising, and navigation.

The authors discuss the advantages and disadvantages of location-based services in the future while describing the main characteristics and features of each type of service. In addition, the paper offers a critical assessment of the development and innovation potential of location-based services as they stand right now [7].

III. METHODOLOGY

The Arduino Nano is a good choice for this object tracking system because it is small, affordable, easy to use, and versatile. It also supports serial communication, which is essential for transmitting the location of the tracked object to a server.

- It is a popular Arduino board that is well-suited for a variety of applications.
- It has a built-in SIM card slot, and it can be used to send and receive SMS messages, make and receive voice calls, and transmit data over the internet.
- This is useful for connecting multiple sensors to a microcontroller, such as the Arduino Nano.
- Overall, the Arduino Nano is a good choice for this object tracking system because it is a compact, cost-effective, easy to use, versatile, and well-supported platform.

The following are the functionalities of each component:

1) *Arduino Nano*

- o Control the SIM800L module and the multiplexer
- o Process the data from the sensors
- o Send the location of the tracked object to the server

2) *SIM800L module:*

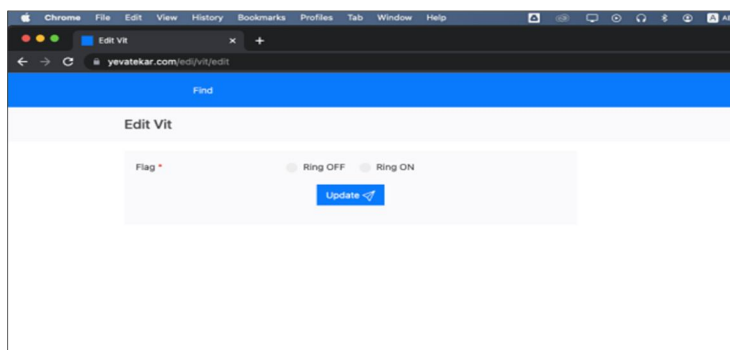
- o Transmit the location of the tracked object to the server

3) *Multiplexer*

- o Connect multiple sensors to the Arduino Nano

A Webpage controlled Microcontroller-Unit (MCU) work in unison to attain the desired output. The Hardware unit has a Microcontroller-Unit (MCU) consisting of a Arduino Nano with a Multiplexer, Sim800l which is a GSM (Global System for Mobile communication) Module and a various Buzzer Units consisting of a Microcontroller and Piezo Buzzer.

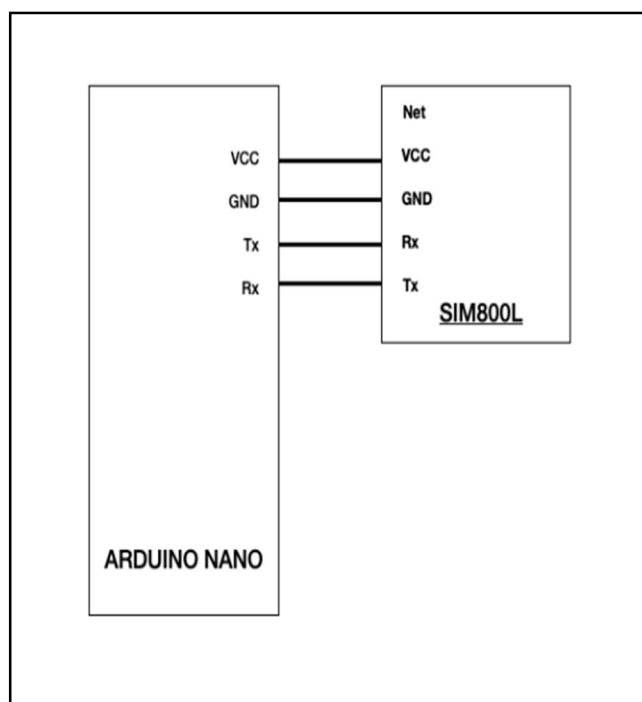
The Web interface is built using Object Oriented Programming in PHP, HTML, CSS and JavaScript. The Webpage is supported with a MySQL Database, which registers all kinds of records updated via a user on the Website.



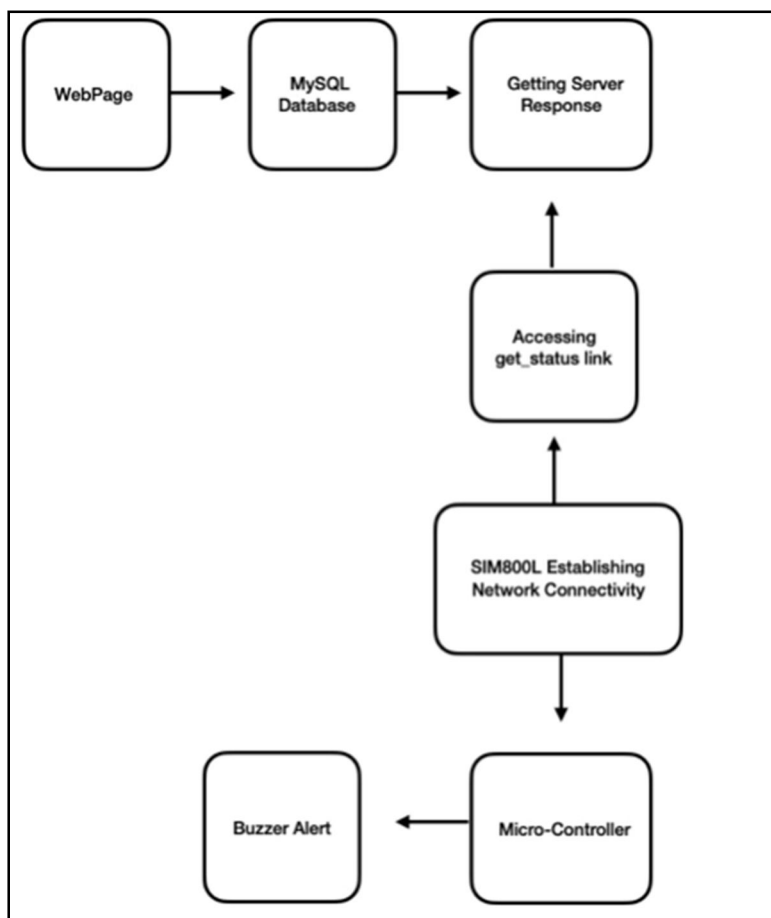
(Fig.1 Web Interface)

The Webpage asks to either 'Ring ON' or 'Ring OFF'. This Update is registered in the MySQL table, which allows our MCU to act accordingly in synchronization. The record added in the MySQL database is fetched using a server response request made by the browser to the MySQL server. For Ring ON {"flag": "1"} response is fetched while for Ring OFF {"flag": "0"} response is seen. These responses are changed in real time with respect to the Webpage.

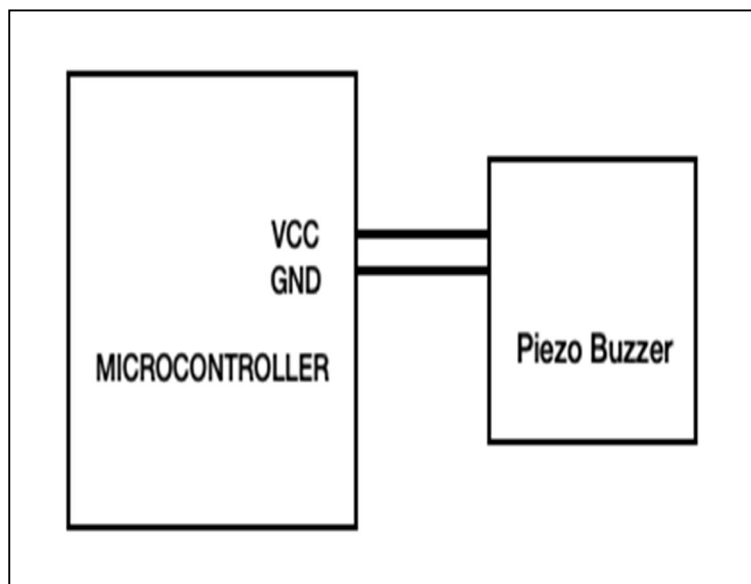
In the Microcontroller-Unit (MCU), A serial interface is used to connect the SIM800L module to the Arduino Nano board and acts as a bridge between our Web Page and hardware module. AT Commands are used to establish an Internet Connection via SIM800L module. The GSM module is capable of doing all the primary tasks of a cellular SIM card, sending and receiving a text message, making and receiving calls, establishing an internet connection, etc. The established network connectivity is used via the Httpget function to constantly hit the server response link with a two second delay for any update. The constant execution of AT Commands in a loop ensures that the Hardware Unit and the Software interface remain constantly in synchronization. Any kind of response fetched from the server is communicated to the Arduino Nano board or the Microcontroller Unit. The 8:1 Multiplexer with the Arduino Nano receives the multiple signals with respect to the response fetched by the Httpget function, either {"flag": "1"} i.e. Ring ON or {"flag": "0"} i.e. Ring OFF. The Multiplexer sends them as in one single output signal to the 8 Buzzer units controlled by the Microcontroller Unit. This signal operates the Buzzer unit and turns the Buzzer High or Low respectively. Creating a Buzzer alert on Ring ON and stopping the alter on Ring OFF.



(Fig.2 System Architecture)



(Fig.3 Microcontroller Unit (MCU))



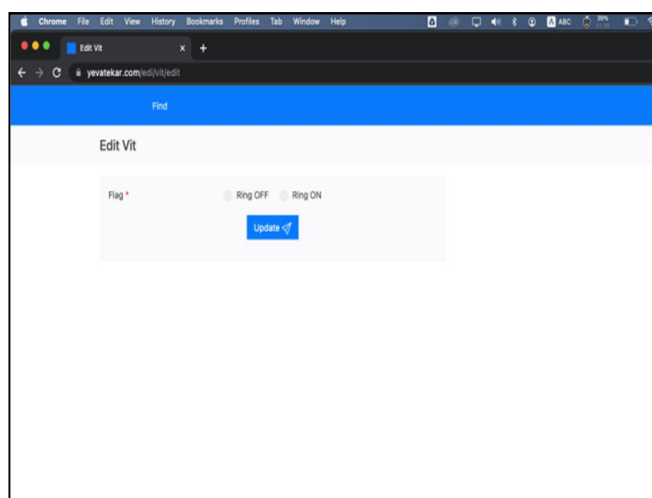
(Fig.4 Buzzer Unit)

The connections between Arduino nano sim800l and piezo buzzer are as follows:

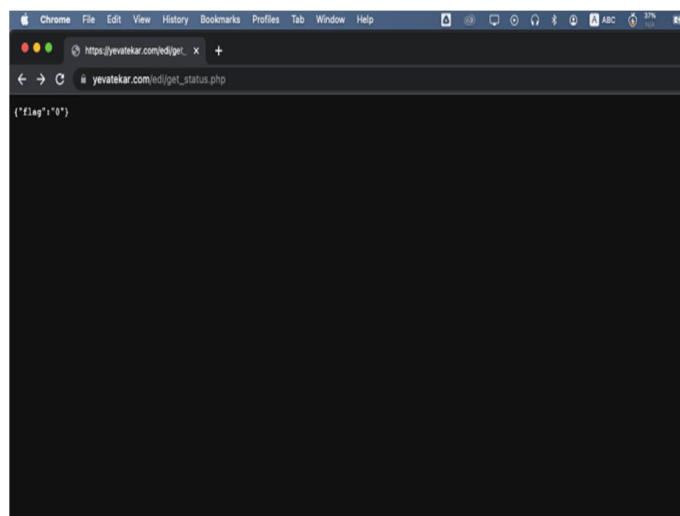
- 1) Arduino Nano and SIM800L Connection:
- 2) VCC of the SIM800L module is connected to the 5V pin of the Arduino Nano.
- 3) GND of the SIM800L module is connected to the GND pin of the Arduino Nano.
- 4) TX of the SIM800L module is connected to the RX pin (pin 0) of the Arduino Nano.
- 5) RX of the SIM800L module is connected to the TX pin (pin 1) of the Arduino Nano.
- 6) Arduino Nano and Piezo Buzzer Connection:
- 7) One terminal of the piezo buzzer is connected to a digital pin (we used pin 2) of the Arduino Nano.
- 8) The other terminal of the piezo buzzer is connected to the GND pin of the Arduino Nano.

IV. RESULTS AND DISCUSSIONS

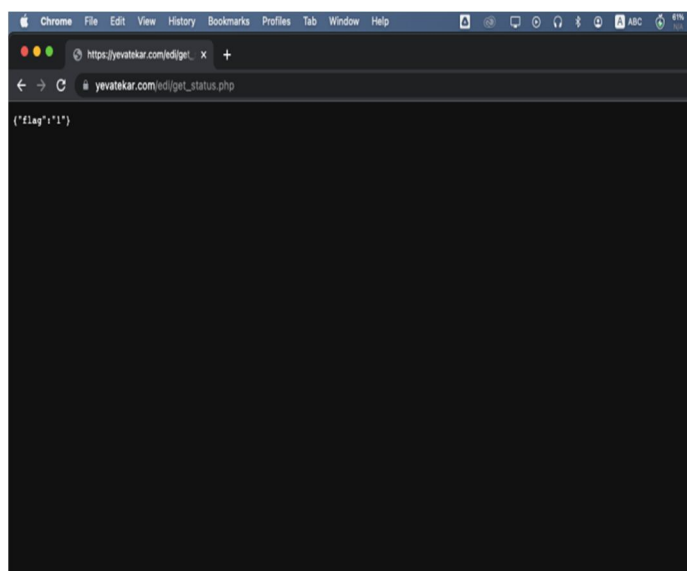
In this research project, we successfully developed a compact and cost-effective object tracker device that can be remotely controlled through a web interface. Our device was designed using the Arduino Nano microcontroller board and SIM800L module, with high accuracy and synchronization. With was a thoroughly tested and promising result. The lack of Serial or Bluetooth connectivity gives our module a significant radius of operation. Hence highlighting the potential of our system for different applications, including personal tracking and security.



(Fig.5 Web Interface)

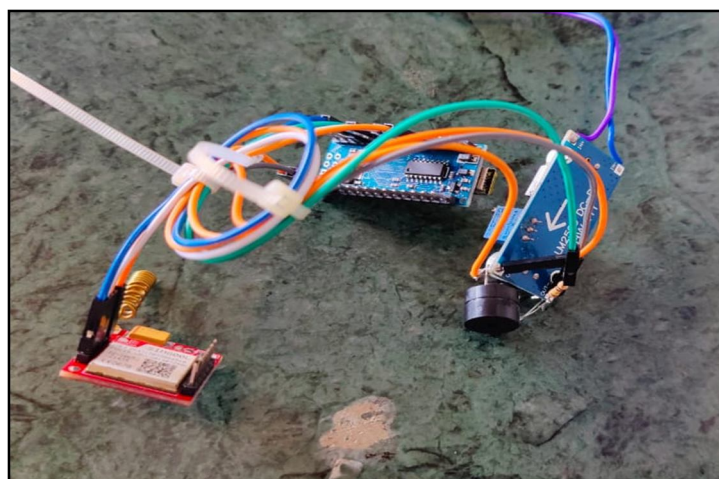


(Fig6.(a) Server Responses)



(Fig6.(b) Server Responses)

Our research project is excellent for various practical applications as a key finder, a mobile finder, tracking a lost household items. The multiplexing of signals received from the database excels the prospect of our project for a wider audience as also being affordable and accessible. Additionally, our research project shows how inexpensive tools can be used to create efficient object/location tracking solutions with real-world applications in a multiple fields and industries. Even using the same hardware and software units, few AT Commands could be added for sending any message alerts hence making our project more efficient and reliable. Overall, our research demonstrates the potential of affordable and widely available devices to create practical location tracking solutions.



(Fig7. Microcontroller Unit)

V. CONCLUSION

We successfully developed an ObjectTracking device that can be remotely controlled through a website. The Microcontroller-Unit (MCU) was designed using the Arduino Nano microcontroller boardSIM800L module and a 8:1 Multiplexer, ensuring it to be cost efficient and accessible for a wider audience. The device's accuracy and reliability were tested, and it performed as expected, with the ability to locate the object was tested. The Server Response time was deeply scrutinised. The HTTP get function was tested to fetch accurate server responses. The Microcontroller Unit was tested to establish stable Internet Connection and sending accurate signals to the Buzzer Units.

VI. FUTURE SCOPE

This research paper presents a novel object tracking system that is compact, cost-effective, and remotely controllable through a web interface. The system uses a combination of Arduino Nano, SIM800L module, and a multiplexer to achieve high accuracy and synchronization. The system has the potential to be used in a variety of practical applications, such as key finder, mobile tracker, and tracking lost household item

Improve the accuracy and reliability of the system. This could be done by using more sophisticated location tracking techniques, such as GPS or Wi-Fi triangulation.

Extend the range of operation of the system. This could be done by using a different cellular module or by using a combination of cellular and other wireless technologies, such as Bluetooth or LoRa.

Add additional features to the system. For example, the system could be equipped with a camera to allow users to remotely view the location of the tracked object. Or, the system could be integrated with other smart home devices to provide more comprehensive tracking and security solutions.

Develop a mobile app for the system. This would make it easier for users to control the system and view the location of the tracked object on the go.

Make the system more affordable and accessible. This could be done by using less expensive components or by developing open-source hardware and software.

Overall, the research paper presents a promising foundation for future research on object tracking systems. The system has the potential to be used in a variety of practical applications and to improve the safety and security of people and property.

VII. ACKNOWLEDGEMENT

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