Implementation of Green Wave System And Detection of Stolen Vehicles

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Abstract—The vehicle tracking system has grabbed huge attention due to the increase in the number of vehicle thefts. It is a tedious process to identify the stolen vehicle and consumes more time when compared to physical inspection. In this paper, detection of stolen vehicles by implementing the green wave system using LoRa is presented. The continuous transmission of signals from LoRa is known as "Green Wave".This system has two parts: One part is implemented in the vehicle in which a LoRa, relay and buzzer is connected to the Arduino Nano. The other part of the system is implemented either in traffic signal or smart pole in which LoRa is connected to Node MCU, is linked to the cloud server. The location of the vehicle is read when it enters the range covered by the LoRa placed in the signal and this location details is stored as a database.Thus if the vehicle is stolen,it can be located easily and quickly by viewing the location history. Once the vehicle is located,it can be halted from a remote location using the website by turning off the ignition system of the vehicle.

*Keywords—*STOLEN VEHICLE,GREEN WAVE,LoRa.

I. INTRODUCTION

IOT plays a vital role in our day-to-day-life.In simple words, IOT is the interconnection of a number of devices via internet.It has created a great impact on industries as they reduce manual labour and are cost-efficient.The industries that use IOT solutions are Manufacturing industries,Healthcare,Agriculture,Banking&Finance,Transportation and many more.The use of IOT varies from one sector to another.IOT allows device to device communication which exchanges data among several devices at close proximity thus resulting in enhanced data rates and reduced latency which is essential for implementation of real-time needs.

As the number of vehicles on the roads increases the number of theft cases also increases.It is a major issue the entire world is facing now.Vehicle theft happens when parked and left unnoticed for a long time or while driving in unsafe areas but mostly due to the carelessness of the vehicle owner as they leave the key in the vehicle itself.Vehicle theft results in huge property loss.People of Metropolitan cities are the major victims of vehicle thefts. Whenever a vehicle is theft the major task is to find the current location of the vehicle which is the most difficult one as it requires physical inspection which consumes a lot of time.The process becomes more complicated if the original number plate gets changed and alteration is done to the colour of and other parts of the vehicle.

In this project Green Wave System is implemented to locate theft vehicle quickly and to immobilize it remotely and this is achieved using IOT."Green Wave" is the continuous wireless transmission of signals from a device.Various devices are used to implement Green Wave system,here LoRa is used.LoRa stands for Long Range which are low power wireless RF modules.As the name indicates LoRa covers a long range of up to 15-20 km and has a long battery life in excess of 10 years.Basically it was developed for IOT and M2M communication by a french company called Cycleo and later it was acquired by Semtech in 2012.It is derived from Chirp Spread Spectrum(CSS)technology and information is encoded on radio waves using chirp pulses.It has 3 license free sub- gigahertz bands of 915 MHz,868 MHz & 433 MHz.LoRa is a transceiver and a thousands of end devices are supported by a single gateway.

II. EXISTINGSYSTEM

Currently,there is no effective technology used to record the details of the vehicle that are passing a signal intersection.Physical inspection is done to record the details which is a time consuming process and it is also difficult to record the details of each and every vehicle manually.Hence there is a need for automatic collection and storage of information of the vehicles passing a traffic signal.Whenever a vehicle is stolen the location of the vehicle can only be assumed by monitoring the CCTV footage recorded by the CCTV cameras placed in each signal intersection and thus there is a very less possibility of recovering the stolen vehicles.GPS technology to track the vehicles is implemented in some vehicles but the disadvantage is that if the vehicle is hid under a place it cannot be detected and also the system does not work in places where there is no internet connectivity.

III. PROPOSEDSYSTEM

In the proposed work, the Green wave system is implemented using LoRa.It has two setups - transmitter setup and receiver setup. The transmitter setup consists of a LoRa ,a relay and a buzzer connected to the Arduino Nano micro controller . The relay of this setup is connected to the ignition system of the vehicle. The receiver setup has a LoRa connected to the Node MCU, which has an in built Wi-Fi connected to the cloud server of either the smart pole or the traffic signal.

Whenever the vehicle with the transmitter setup comes within the range covered by the LoRa of the receiver setup the signal transmitted from the vehicle is received by the LoRa of the receiver setup and the details of the vehicle such as Vehicle owner name, Vehicle name, Location and Date &time of the vehicle are updated to the cloud server and thus a database is created.Thus when a vehicle is stolen the user can login to the website using vehicle number and can view the location of the vehicle and the vehicle can be immobilized and the buzzer can be turned on if needed using the provided website from any remote location and the whole process is done by the full duplex communication between the LoRa modules.
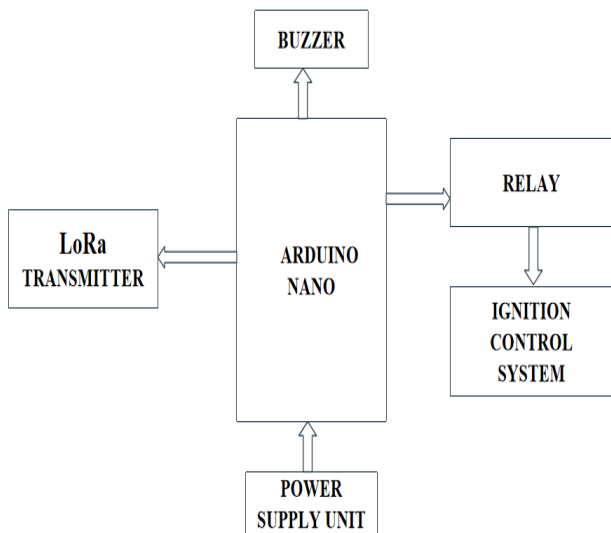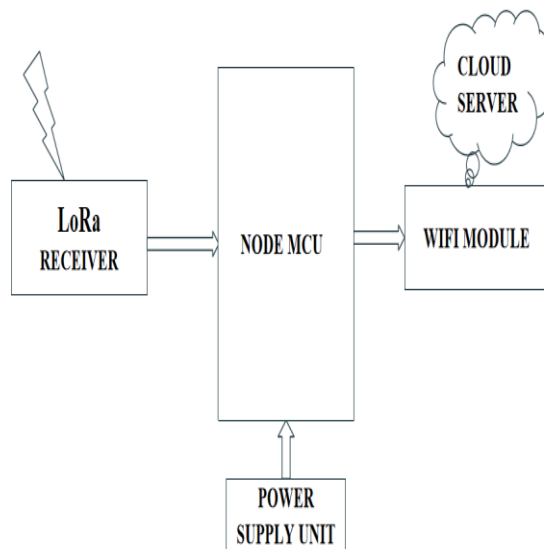
IV. BLOCKDIAGRAM

Fig 1.Transmitter Setup   Fig 2.Receiver Setup

V. EXPERIMENTAL SETUP

A)Transmitter setup
The components used are:
❖   Arduino Nano (ATmega328)
❖   LoRa (Ra-02)
❖   Single channel Relay
❖   Buzzer
❖   Led

In this setup,the D10,D11,D12,D13 which are the SPI pins and D2,D9 pins of Arduino Nano are connected to the LoRa pins with the help of jumper wires.Relay is connected to the D3 pin and buzzer is connected to the D4 pin of Arduino Nano. A led is also connected to indicate the activation of LoRa.After completion of this process the Arduino Nano board is programmed using Arduino IDE software.Serial communication is done between the LoRa and the micro controller.The setup is then fixed to the vehicle by connecting the NO and COM pins of relay to the ignition system of the vehicle.

B)Receiver setup
The components used are:
❖   Node MCU(ESP8266)
❖   LoRa (Ra-02)
❖   Led

In this setup,the D5,D6,D7,D8 which are the SPI pins and the A0,D0 pins of Node MCU are connected to the LoRa pins with the help of jumper wires.A led is also connected to indicate the activation of LoRa . After completion of this process the Node MCU is programmed using Arduino IDE software.Serial communication is done between the LoRa and the micro controller.The setup is to be fixed either in the smart pole or the traffic signal.Internet connection is to be provided to the micro controller from the smart pole or traffic signal.

The web page is designed using MySQL and PHP.A login page is created where theft vehicle number is to be entered.The page is then redirected where the vehicle details such as Vehicle owner name, Vehicle name, Vehicle Location ,Date &time is displayed and an option Vehicle theft is provided where the status of the vehicle is to be selected as Theft/No theft initially it will be as select.If theft is selected options to turn on/off vehicle and turn on/off buzzer is displayed.A history option is also provided which when clicked will show a database where the location details of the vehicle can be viewed.

VI. PROCEDURE

The LoRa used in this project supports a license free band of 433 MHz which covers a range of 10,000 meters but the range is reduced as per the obstacles available in between the LoRa modules of the transmitter setup and the receiver setup.

Whenever a vehicle with the transmitter setup enters the range covered by the receiver setup placed in the smart pole ,the signal transmitted from the vehicle is received by the LoRa of the receiver setup and the details are updated in the cloud server.Thus a database consisting the details of the vehicles crossing the smart pole is created.If the vehicle is theft the user has to login to the web page by entering the vehicle number, the page is redirected where the user can view the location details of his vehicle using the history option provided.And if the user wishes to immobilize the vehicle he has to select the option as theft in the vehicle theft option provided and the options to turn on/off the vehicle and buzzer will be displayed as ON/OFF and ALERT ON/OFF the user has to click the OFF button to turn off the ignition system of the vehicle.The buzzer can be turned on by clicking the ALERT ON button such that the people in the surrounding area can help us to recover the vehicle and also it can be used to identify our vehicle if alteration in to the number plate or colour of the vehicle.
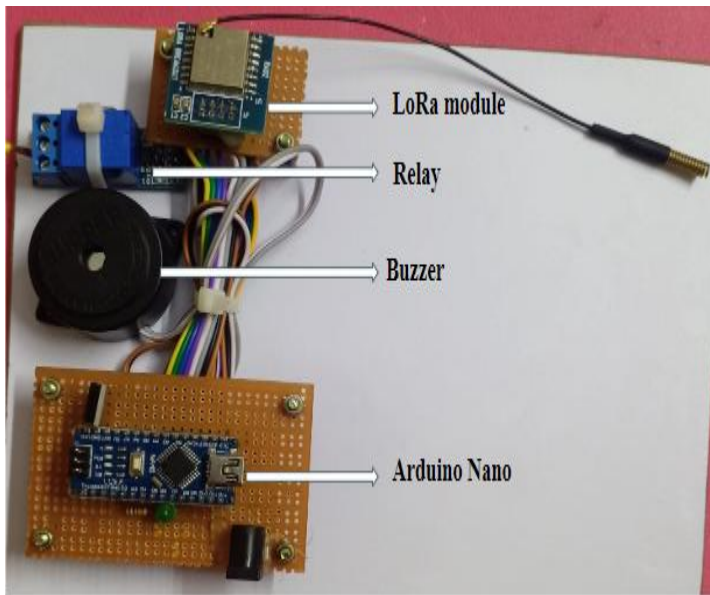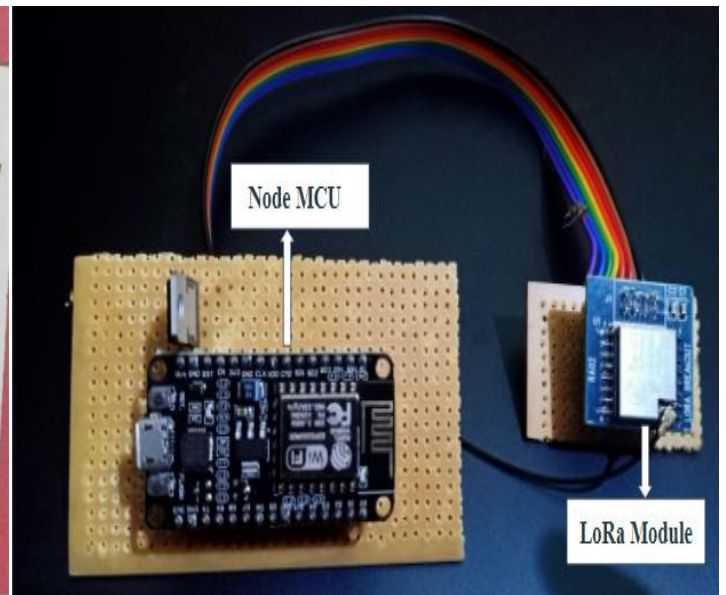
VII. RESULT

Fig 3.Transmitter Setup hardware

Fig 4.Receiver Setup hardware

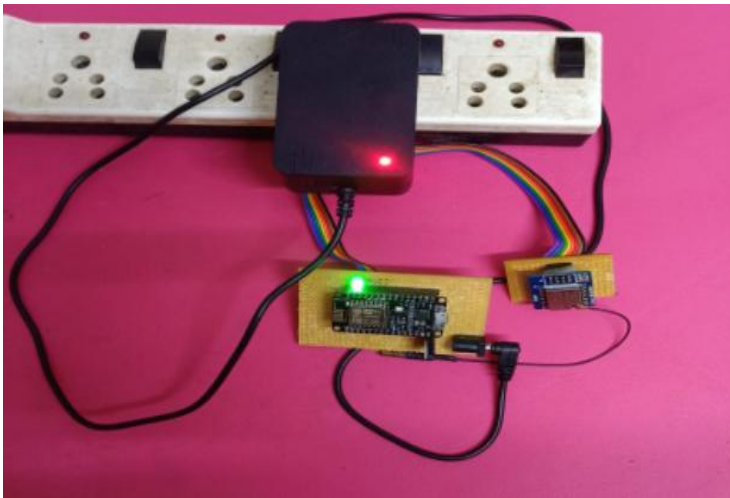Fig 5.Front view of vehicle

Fig 6.Transmitter setup fixed in vehicle

Fig 7.Receiver setup to be placed in smart pole   Fig 8.Login Page

Fig 9.Display page of vehicle details

S.no	Vehicle name	Vehicle Owner	Vehicle Location	Date & Time
1	Activa	Amreen	Kodambakkam	2023-05-19 16:41:15
2	Activa	Amreen	Kodambakkam	2023-05-19 16:41:09
3	Activa	Amreen	Kodambakkam	2023-05-19 16:41:05
4	Activa	Amreen	Kodambakkam	2023-05-19 16:41:00
5	Activa	Amreen	Kodambakkam	2023-05-19 16:40:56
6	Activa	Amreen	Kodambakkam	2023-05-19 16:40:52
7	Activa	Amreen	Kodambakkam	2023-05-19 16:40:50
8	Activa	Amreen	Kodambakkam	2023-05-19 16:40:44
9	Activa	Amreen	Kodambakkam	2023-05-19 16:40:39
10	Activa	Amreen	Kodambakkam	2023-05-19 16:40:34

Fig 10.Database of location details of the vehicle

Fig 11.Options available in vehicle theft

Fig 12.Options displayed when theft is selected

VIII.   APPLICATIONS AND FUTUREENHANCEMENT

- ❖ Very useful in the detection of theft vehicles .

- ❖ Remote control and data collection and storage system.

- ❖ In the upcoming years, the system can be upgraded by providing limited touch access and to cover larger distances.

- ❖ Additional features such as alcohol detection, seat belt detection, helmet detection can be added and alert notifications can be sent to the control room.

- ❖ Exact location can be identified .

IX. CONCLUSION

In this project, the theft vehicle can be located within a short period of time using the location history of the vehicle stored in the cloud server.The ignition system of the vehicle can be turned off from a remote location using the website and the buzzer can also be turned on to alert the people around thus it results in a speedy recovery of the vehicle.An automatic record of the vehicles passing a signal intersection is also made without manual labour.

X. ABBREVATION

- ❖ LoRa - Long Range

- ❖ MCU - Micro controller Unit

- ❖ IOT - Internet of Things

- ❖ RF - Radio Frequency

- ❖ M2M - Machine to Machine

- ❖ CCTV - Closed-Circuit Television

- ❖ GPS - Global Positioning System

- ❖ Wi-Fi - Wireless Fidelity

- ❖ LED - Light Emitting Diode

- ❖ IDE - Integrated Development Environment

- ❖ NO - Normally Open

- ❖ COM - Common

- ❖ SQL - Structured Query Language

- ❖ PHP - Hypertext Preprocessor

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