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Shipping Container Monitoring Cum Tracking System Designed With GPS & GSM

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ABSTRACT

A shipping container is a device which is used to transport the materials through it. The main task of this project is to track the container and monitor it. The tracking helps in knowing the current location of the container. And one more important aspect of this project is that if there are any food items transporting in the container, it is important to reach the material in time otherwise the food gets spoiled due to over temperature and humidity present in the container. An alarm is used to notify the transporter when the temperature rises above the set value. This container tracking system is an electronic device designed by using GSM(Global System for Mobile communication) and GPS(Global Positioning System) modules interfaced with Arduino Uno board. The GPS will have a continuous communication link with the concern satellites in which it helps in gathering the global position data from them. The global position values are given in the form of latitudes and longitudes. And this data is fetched in the Arduino board. This Arduino board is programmed in such a way that it displays the latitude and longitude values of the position on a display which is connected to it. It also sends the data to the mobile number that has been programmed in the Arduino Uno through the GSM module. The GSM module doesn't have any range restrictions, so the data can be transmitted to the device irrespective of the location of the device on the globe. Since the system needed to be carried to different locations on the earth to gather the different locations data, the system is designed as portable. We cannot charge the system where ever we want, so the system is designed with a high power rechargeable battery to escape this flaw.

Key Words: Main processing unit designed with Arduino Uno board, GSM module, GPS module, LCD, 12V-2Ah rechargeable battery with its charger, Buzzer, DHT11 sensor, etc.

1. INTRODUCTION

The main purpose for designing the project is to track the position of the shipping container and to monitor the temperature and humidity present in the container. For this the GSM and GPS modules are connected to the main processing unit i.e Arduino Uno board. The Arduino board is programmed in such a way that it collects the data from the GPS module. The data collected will be as latitude and longitude values. This data collected is sent to the respective user by using the GSM module. In addition, the temperature and humidity present in the container is also transmitted to the same user. And the data acquired is displayed on LCD which is interfaced accordingly to the Arduino Uno board.

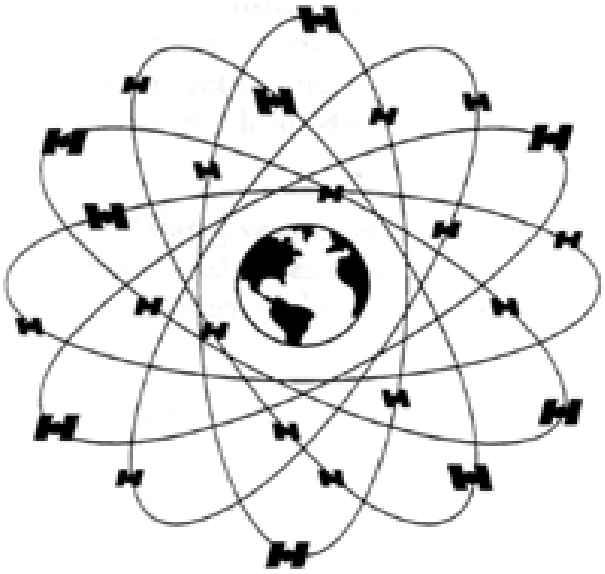
In this project, the container is tracked continuously and its data will be sent to the concern user's mobile phone. There are many satellites present in the space which revolve around the earth. 24 satellites of those locate every place on earth. To track any location on earth these satellites transmit the signals of the place. And those signals are collected by the receiver i.e antennas at the receiver end. As the earth locations are correctly located by using the latitude and longitude. To locate every part of the earth it is surrounded by four satellites continuously. These satellites help in continuous tracking of our system.

1.1 GPS

In GPS module, the antenna present in it receives the coordinates from the satellites which helps in tracking of the system. GPS consists of 3 segments. They are:

1.1.1 Space segment

It comprises a network of satellites which includes 24 satellites. These are located 20,200 kms above the earth, it takes around 12 hours each to revolve around the earth.



1.1.2 User segment
It consists of the equipment needed for the people and the military servants in order to receive the navigation signals.

1.1.3 Control segment
GPS control segment includes of ground antennas that track the GPS satellites, and monitor their transmission signals and predicts the behaviour of the satellites.
There are three control segment elements:

1.1.3.1 Monitor Stations
It collects the navigation signals and tracks the GPS satellites as they pass overhead.

1.1.3.2 Master Control Station
It uses the data to find the precise location of the satellites and provides control and command of the GPS constellation.

1.1.3.3 Ground Antennas:
It receives the signals from the satellites and analyses the information present in it which helps in getting the coordinates.

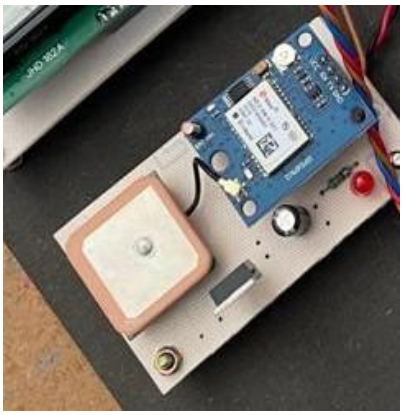


Fig 1. GPS module

1.2 GSM

Here the GSM module is used because it doesn't have any range restrictions around the earth. Any device which is needed to be controlled and it can be operated from anywhere. GSM calls are generally based on voice or data. This GSM module is responsible for the continuous communication between the host i.e user and the system. It sends the host all the required data in the form of SMS(Short Messaging Service) which consists of temperature, humidity and GPS coordinates(i.e latitude and longitude). It requires a SIM (Subscriber Identity Module) card similar to mobile phones for activating the communication with the device and network. When the GSM module is supplied with the power, it takes a some time to receive the signals from satellites via antenna. After the signals got reached, the network inserted in the GSM module sends the data to the receiver mobile number which has been programmed in the Arduino Uno board.

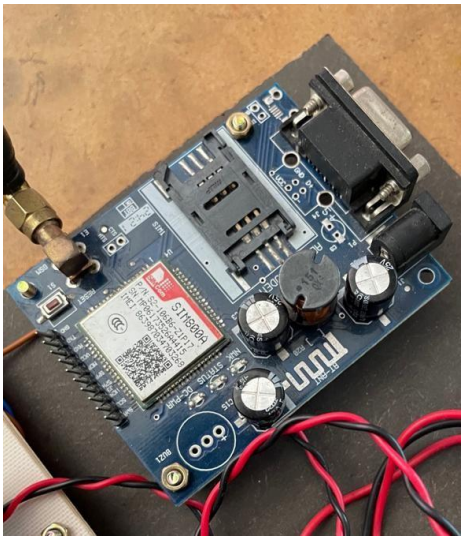


Fig 2. GSM module

1.3 Arduino Uno Board

The main processing unit used in here is the Arduino Uno board. It is constructed by using the single chip microcontroller which is ATmega328. Arduino is an open-source electronics platform. It consists of 20 digital input/output pins. In those pins 6 can be used as PWM outputs and another 6 can be used as analog inputs. In Arduino, the programming can be done easily by using Arduino USB port. The programming language used while dumping the code in the Arduino is the C/C++ language. Any Micro-controller built in with Arduino works accordingly as per the program programmed in it. The program is programmed in such a way that the micro controller can read the data from GPS module and can store it accordingly. As per the received information from GPS, the microcontroller displays the global position data through LCD.

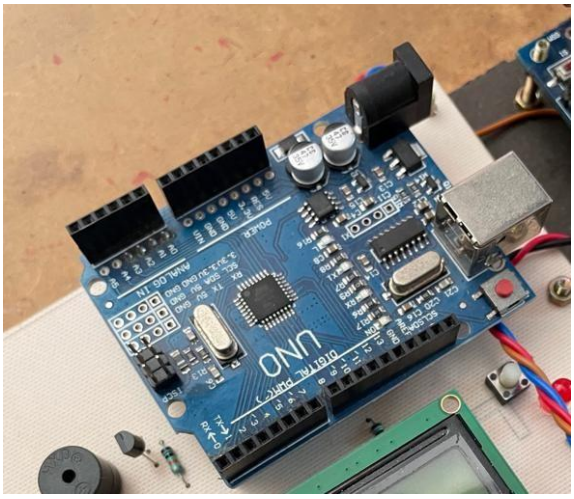


Fig 3. Arduino Uno board

2. LITERATURE SURVEY

In [1], they have created a system which tracks the vehicles in the real-time by using the GSM module and the system also notifies when there is a chance of robbery or any accident occurs. They have transmitted the data via internet using the TCP/IP internet protocols.

[4] is a device which is used to monitor the radiation through SMS. The system leaves an SMS to the host server when the radiation value reaches or increases the certain set value. And it transmits the data through SMS at every fixed interval as programmed in the microcontroller.

We can a see a system that has been developed in [2], which gives the coordinates of the vehicle by interfacing a GPS and GSM to the AT89C51 microcontroller. The system provides the latitude and longitude to the mobile phone so that the vehicle can be tracked.

[3] explains the tracking of people in order to prevent from the COVID-19 virus. They have combined the information from the online surveys and mobile tracking devices to measure the number of contacts between the people. This helps in tracing and preventing from the disease.

In [5], they have designed a system for monitoring the forest. By using a DHT11 sensor interfaced to the microcontroller, they collect the data from the forest at regular intervals which helps in prevention of forests. The microcontroller is programmed in such a way that it gives an alarm when the temperature raises certain set value.

PROPOSED METHODOLOGY

The main reason behind building this project is to design a system where any object can be tracked and monitored based on the user requirements. The GPS module for location of the object, GSM module for transmitting the information to the concern mobile phone for proper communication and the Arduino Uno make up the system foundation. This embedded controller is used to monitor the data in the real-time. The location received from the GPS and temperature humidity from DHT11 sensor is collected by Arduino and transmitted to the concern mobile phone by GSM. It also shows the same data on the LCD panel which is interfaced to the Arduino. It also gives a buzzer sound notifying that the temperature has raised the set level which has been programmed in the Arduino.

3. PRINCIPLES OF OPERATION

3.1 Power Supply

The battery connected in the system is a rechargeable battery which is of 12V-2000mAh. The GSM module needs 700mAh, GPS module needs 500mAh and the control circuit need 150mAh. Total together the system confined nearly 1350mAh. The battery backup time is about 1.4hours and it nearly takes 4hours to charge the battery.

3.2 Voltage amplifier

Since the output from the load cell is only in millivolts, the Arduino Uno board cannot handle it. Therefore, we use a voltage amplifier to boost the voltage.

3.3 LCD:

A 16x2 LCD display with 32 pins is used in the system. In our project, the LCD is used to project coordinates, temperature and humidity. If the coordinates are not updated it shows “NO GPS”.

3.4 Buzzer

The buzzer is used here to indicate temperature when it reaches or raises above the set level mentioned in the Arduino code.

3.5 GPS(Global Positioning System)

The purpose of GPS is to collect the coordinates from the satellites and update the information to the Arduino. This information helps in tracking of the container where ever it is on earth. The latitude and longitude collected from this are helpful in tracking the container.

3.6 GSM(Global System for Mobile Communication)

The purpose of GSM is to transmit the data from the Arduino to the concern mobile network via SMS. This SMS consists of GPS coordinates, temperature, humidity and link that directs automatically to the google maps tracking the container.

4. RESULT

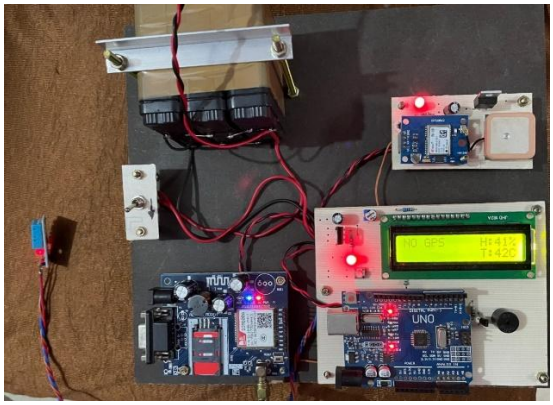


Fig 4. circuit

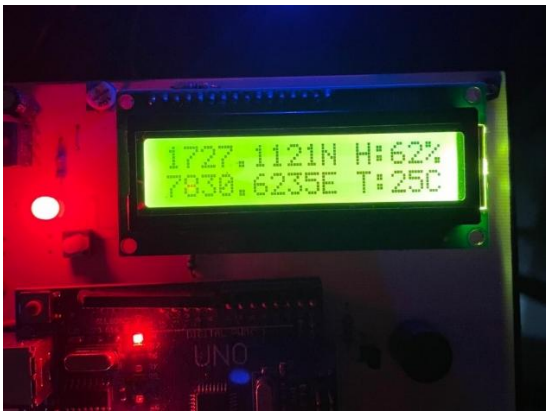


Fig 5. GPS coordinates, temperature and humidity on LCD display

Fig 6. LCD display showing No GPS, temperature and humidity

Fig 7. LCD display showing sending SMS, temperature and humidity

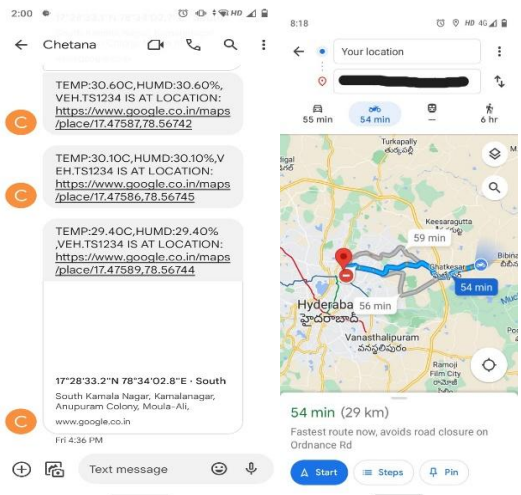


Fig 8. SMS and location tracking in google maps

CONCLUSION

The use of tracking a system is to know the location or direction of the object. A tracking system would maintain constant contact and update the object's position over the globe. The final output of the tracking system will be transmitted to the concern mobile phone through GSM module.

The Project titled "Shipping container monitoring cum tracking system designed with GPS & GSM" is a model for container tracking system which can be used for practical utilization by converting the system in to engineering module. Since it is a prototype module, all devices are exposed and are arranged over a wooden plank for demonstration purpose. The GPS used in the system acquires global position data as latitude and longitude, these co-ordinates values must be entered in the Google maps to know the exact location which will be displayed through computer monitor. Presently the system is designed to monitor the temperature and humidity parameters along with position of the container and if required other parameters data also can be transmitted to the concern mobile phone.

The positioning of the object is done in as latitude and longitude along with the perfect location of the location, by using Google maps. The system created tracks the place of the container and transmits to the concerned users mobile number in the form of SMS. The received information can be displayed through LCD interfaced with Arduino board and this is the main processing unit. The information displayed through LCD is also transmitted to the concern mobile phone through GSM module. Since the GPS device used in the project work belongs to commercial model by which the location accuracy will be around 15 square meters.

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