

Location Monitoring System using Raspberry Pi

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Abstract

With the new advancement in technologies and with increased number of satellite dedicated for navigation purpose the tracking system has evolved. The hardware costing of a commercial tracking system makes it difficult to make available for use for the masses mostly in the developing countries. In the proposed system, the concerned user can define its own boundary. This system will be recording the position and at the same time it will be checking whether the object is in the defined boundaries and crossing boundaries or moving from one boundary to another to prompt the user. This system will demonstrate the implementation of Location Monitoring System using a Raspberry Pi and server for recording positions and defining and displaying the same on an android application provided to the user.

Keywords: location monitoring system, Raspberry Pi, GPS, GSM, Android

I. INTRODUCTION

A Location Monitoring System is nothing but a system that will monitor the location of any object and will send the updates about the location to the user. The object can be anything or anyone- vehicle, old people, children, precious jewellery, and hikers and so on. Here the user may want to set a boundary region of the object. If that object goes beyond that specified boundary intentionally or unintentionally, our system will give updates to the user about the whereabouts of the object. If suppose the user is not connected to the internet, there is also a facility of receiving an update through text message or SMS.

Traditional tracking systems use Global Positioning System and Global System for Mobile Communication i.e. GPS-GSM based systems for tracking the location of any object, say a vehicle. Global Positioning System contains a module that receives the GPS signal using which it will calculate the co-ordinates. These co-ordinates will then decide the location of the vehicle. The GSM modem relays this calculated location to the user through an SMS. GPS based tracking system, however, does not allow the user to define his own boundaries. Also, it will give the updates to the user only when the user demands it.

RF based system i.e. Radio Frequency based systems use Radio Frequency identification to track any object. These systems make use to tags that can be attached to any object that needs to be tracked. This system consists of three parts i.e. the antenna, a transceiver and a tag. The object bearing the tag can be tracked via radio waves from several meters apart. The drawback is that it might happen that more than one tag within the same area might respond to the user. This creates confusion about the precise location to the user.

We intend to use a different mechanism altogether to avoid the drawbacks of the traditional tracking systems. We plan to use a relatively new technology i.e. Raspberry Pi. A Raspberry Pi is a mini computer, the size of a credit card that can be plugged onto devices such as a television or a monitor. It is low cost and can do everything that a normal computer can do. It can do word processing; you can even play games on it. Raspberry Pi may use a keyboard and a mouse for easy navigation. It was developed in the United Kingdom with a view that could encourage computer science teaching in schools. Raspberry Pi comes in different models such as model A, B, A+ and B+. Several up gradations have been made to the earlier models. The models A and A+ did not have the facility of USB hub and Ethernet which are available in Models B and B+.

II. RELATED WORK

GPS-GSM based tracking system [1] is nothing but a GPS based tracking system that aims to determine the exact location of any object that is being tracked. The object is attached to a GPS system and with the help of a GSM modem the object's location can be known to the user. Proposed system also aims to provide actual monitoring of the object by the help of tele-monitoring technology for long distance vehicle tracking such as Inter-city transport. System is a circuit board consisting of a GSM and GPS modem and an ARM processor. This circuit board would be installed in the vehicle that needs to be tracked. An SMS will be sent to the user which will consist of the location of the vehicle while the vehicle is moving. The technology is such that is continuously sends location of the vehicle to the user by an SMS. If the user wishes, he can send an SMS which would stop the vehicle too. By this it achieves real time control of the vehicle. This system can be used for traffic analysis, tracking of public transport, information regarding the location of a vehicle and so on. It doesn't allow the user to define his boundary and if the

object leaves the boundary, the user would not get any notification. This system sends the updates on demand. It is power inefficient as it will continuously send the location updates to the user. Tele-monitoring will increase the cost of the system. Coordinates will be provided instead of the actual location name which makes it difficult to understand where exactly the location is.

Land vehicle tracking system [2] helps the user to know the best route to reach a destination point. This can be achieved when the user knows the congestion occurring on a particular road. The system will track the vehicles on the road and the user gets the idea about the traffic on that road and hence will take a different route to save time. This system finds application in many areas such as an emergency rescue, security issues, and vehicle speed control and traffic management. The tracking system is made up of GPS system to locate the vehicles. It also needs the Android Platform to communicate with the user. Using this system anyone can track any vehicle, which may not always be for a good cause. User isn't allowed to define his boundary and track a particular vehicle in that boundary. This system is expensive in terms of resources as well as money. It tracks all vehicles on the road and hence unnecessarily using up more power and resources. There isn't any SMS facility the tracking is only on demand.

Vehicle detection system [3] helps to identify the type of vehicle moving on the road and categorizes into types such as motorcycles, cars, vans, busses etc. Each category then has its respective sub-categories. The identification of vehicles can be done using GMM technology which stands for Gaussian Mixture Model and also removal of shadow. The system is equipped in such a way that it has the ability to deal with changes in the lighting- suddenly bright light or darkness. The system is designed to be used under harsh weather. The efficiency of the system is up to 94% even in bad weather. Huge number of experiments were conducted to develop a precise system such as this one. This system also uses Kalman filter to track a vehicle. The main drawback of this system is that it is meant for public usage and not intended for private usage. It doesn't have any notification facility or an update facility that will let the user know about the location of the user's vehicle. It again tracks all the possible vehicles on the road and doesn't concentrate on just one vehicle at a time. Hence it utilizes a lot of resources by tracking unnecessary vehicles on the road.

Tracking of public transport system [4] such as public busses would help people to save their time. This system also makes use of the traditional GPS-GSM based technology that will help in tracking of the vehicle. The user will get the notification on demand on his android application. The information of the location of the vehicle would be given to the user via the android application as and when the user demands. It also uses another technology i.e. the GCM which stands for Google Cloud Messaging. GCM is open source software that would relay the location information sent by the GPS device. If the user is not connected to the internet, he may not receive any update. An SMS would have worked here. User cannot define any boundary region and anyone can track any vehicle. The system doesn't alert the user unless the user demands it.

III. EXISTING SYSTEM

One of the major concerns nowadays is to monitor the location of people and valuable objects. Many such devices are already available in the market such as devices based on GSM/GPS technology and Systems using RF technology. The GPS/GSM systems don't allow the user to define a particular boundary. They won't notify the user if the object leaves the specified boundary. It will only notify the user on demand. System using RF technology, though better than GPS/GSM system, has a lot of interaction with the server hence it drains the power quickly. Thereby increasing maintenance cost considerably. Also, RF based system is very expensive. Common people cannot afford such expensive devices and also pay for the maintenance separately. Our proposed system will overcome all such drawbacks since we will use Raspberry Pi that is cheap and portable.

A. GSM Based Tracking:

This system uses Global Positioning System (GPS) and Global System for mobile communication for tracking and positioning of any object. This system reports the status of the object on demand by continuously monitoring it. A GSM Modem is used to send the position (i.e. Latitude and Longitude) of an object from a specific place. The GSM Modem will continuously give the latitude and longitude indicating the position of the object. This data is sent to the user by a text message where the position of the object is demanded. One of the major drawbacks of this system is that the user will not get to define a particular area to track the vehicle. This system does not provide an update if the vehicle crosses a defined area. Also, the user will be notified only on demand.

B. Radio Frequency Transmitter Based Tracking System:

The RF transmitter can be attached to any object which has its own identification. This data can be transmitted to the RF receiver connected to the micro controller. The GPS will locate the position of the object and transmit the data to the micro controller. If the object crosses the defined boundary, it automatically sends the location of the object to its owner as a text message through GSM modem.

The drawback of the RF system is that it is very expensive and the technology is difficult to understand. Also, it is power inefficient because it continuously interacts with the server. This will also result in a higher electrical power drain on the transmitter device, which will cause shorter operating life for battery powered devices.

IV. PROPOSED SYSTEM

With the new advancement in technologies and with increased number of satellite dedicated for navigation purpose the tracking system has evolved. The hardware costing of a commercial tracking system makes it difficult to a make available for use for the masses mostly in the developing countries. In the proposed system, the concerned user can define its own boundary. This system will be recording the position and at the same time it will be checking whether the object is in the defined boundaries and crossing boundaries or moving from one boundary to another to prompt the user. This system will demonstrate the implementation of Location Monitoring System using a Raspberry Pi and server for recording positions and defining and displaying the same on an android application provided to the user.

We propose to build a Location Monitoring System using a Raspberry Pi with installed GPS sensors and GSM or CDMA connectivity. This system will help to reduce the number of cases of thefts. It will provide a secured system in which the user can define his own boundary and can monitor it using an android application.

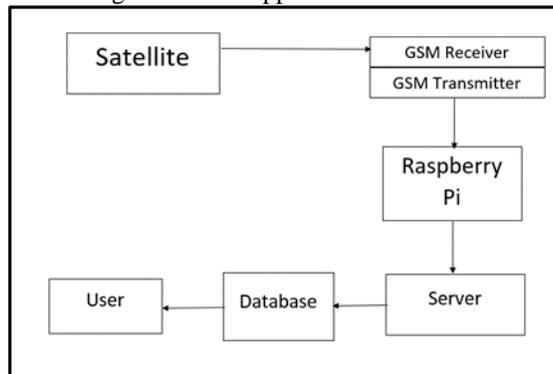


Fig. 1: Proposed System

The two phases of the Proposed System are as follows:

A. Phase 1: Boundary Defining Phase:

In this phase the user gets to define his boundary. The Raspberry pi will be programmed to receive the information about the boundary through the android application. The defined boundary is of circular format for which the user should define a radius. The information about the user along with the pi and associated boundaries will be stored in the database on the server. The server will then provide the same data to the pi which maintains the database about all the boundaries defined by the user and check if the object crosses the boundary or not. This data transfer will be through any GSM or CDMA network.

B. Phase 2: Monitoring Phase:

In this phase the Raspberry Pi will record the location of the object. If the object crosses the defined boundary, it will send a notification to the user on the android application. If the user is in offline mode, then it will send a text message or an SMS instead.

V. COMPARISON BETWEEN EXISTING AND PROPOSED SYSTEM

Table – 1
Comparison Between Existing and Proposed System

System Parameter	GSM/GPS System	RF system	Proposed System
Boundary	No	Yes	Yes
Power Efficient	No	No	Yes
Pocket Friendly	No	No	Yes

VI. SCOPE

Our System will find its application while dealing with thefts of precious objects such as vehicles, jewellery, hikers, old people etc. Using Location Tracker we can help prevent kidnapping of children, thefts of vehicles which are stolen but never found. And since we plan to develop a system that is comparatively less expensive than other systems, most of the people can afford to purchase it.

VII. CONCLUSION

The proposed system aims at reducing the cost of the hardware. This device is relatively very cheap as compared to the other devices using which a user can track any object and define the boundaries as per their requirements.

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