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Research Article on School Bus Tracking System

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Abstract

Bus is a common transport used by public people for daily commutation. The word "tracking" refers identifying the location of a person or an object which remains affecting after unique position toward added. Tracking systems are useful when there is a suspicious movement done by a person. This type of system is useful to track the movement of kidnappers when a kid or an eminent person is kidnapped or sometimes to track the movement of wild animals also these systems are used. If a device is attached with global positioning system (GPS), then it is easy to locate the device. Similarly, this can be attached to any of the physically existing object or on a human being if at all required to track down the location.

This paper does an in depth survey on the current technologies used in the bus tracking system and proposes a new methodology using IOT devices to track the path of the bus used. Many research works are carried on this topic and some of bus tracking systems are developed using GPS, smart phones. To track the path of the buses Google Map can be used so that path used by the bus is the correct track towards spread the end point point after the foundation. The real time application of such systems can be employed for school buses or general transport buses so that if the bus is hijacked, met with some accidents can be identified, bus is arriving late or early.

Keywords: Tracking, IOT, GPS, Smart phone

Introduction

This section of the article introduces the tracking system and IOT technology.

Day by day new technologies are invented and people move mostly towards automated systems. As the world is fully dependent on digitization and automation, the application areas of tracking systems are becoming popular and advancing.

1.1 Definition of tracking system

A global positioning framework, otherwise called as a finding framework, is utilized for the seeing of people or objects progressing and providing an ideal information about the location. In other words, it can be defined as an electronic security gadget which permits to screen the area of an individual or object, especially a vehicle. Another way of definition is, a tracking system implies to an electronic or mechanical gadget that allows an individual to remotely identify or to follow the position or development of an individual or item.

1.2 Real time applications of tracking systems

a)   Used to track the location of employees by organizations

b)   Used in cab business to find the location of client

c)   Google map employs GPS to find the path for reaching the destination.

d)   Organizations use tracking devices to check the employee's attendance marking system

e)   To check the location of wild animals.

Global positioning frameworks should resolve two fundamental issues: movement also, coordinating [1].

i)   Movement issue: anticipate the area of a picture component being followed in the following casing, that is, recognize a restricted search district in which the component is relied upon to be found with high likelihood [1].

ii)   Coordinating with issue: (otherwise called discovery or area) distinguish the picture component in the following edge inside the assigned hunt area [1].

The least complex way to deal with the movement issue is to characterize the search region in the following edge as a fixed-size area encompassing the objective situation in the past outline. The size is picked as per the quality of the issue, vitally the anticipated that frame should outline relocation. Clearly, this information isn't frequently accessible, dependable, or time-autonomous, so execution is restricted. Coordinating measurements and search methods are regularly comparable in surround sound and following, yet the last option can exploit movement forecasts, not accessible to static sound system. A following explicit issue is information affiliation, that is, tracking down the genuine situation of the moving objective within the sight of similarly substantial contender for the closeness metric [1].

Interest in object following emerges because of a few reasons [2]:

•   First and foremost, there is a gigantic development in the powerful PC,

•   also expansion in modest camcorders,

•   thirdly colossal increment for mechanized examination of recordings.

•   For Traffic checking;

•   For observation framework, that is scene checking for recognizing dubious action;

For acknowledgment of movement, that is human distinguishing proof dependent on their movement, object recognition.

In easiest structure, following is primarily characterized as assessing the direction of an item as it moves in a video or on the other hand in the moving scene. What's more, contingent upon following space, one can likewise characterize some data like region, direction, shape and item's driven data.

•   GPS and GSM based vehicle features are explained below [3]:

Prerequisites for fostering the GPS frameworks from the flagging perspective are as per the following [3]:

a) Multiple entrance capacities so no impedance in the GPS signals from different satellites should take place.

b) Avoiding some measure of multipath impedance.

c) Minimization of impedance from sticking, satirizing of sign and so on up to a specific level.

d) Low power signal so it ought not meddle with the microwave view correspondence signals.

According to the task is concern, GPS is the best innovation considering its accessibility and beneficiary expense. Since today every Android telephone accompanies in built GPS beneficiary introduced in it. Consequently, there is no need of buying a different GPS beneficiary for every customer [3].

Today we are utilizing diverse Location Based Administrations like Google Maps, Live vehicle following and other applications [4]. The global positioning framework is a primary piece of the present life [4]. The area global positioning framework assumes an essential part in many fields like taxi administrations, security frameworks, modern purposes and numerous different fields.

Global positioning framework is broadly utilized in our everyday life. Global positioning framework helps us by many purposes like track close by shops, following area of transports trains or some other vehicle. Additionally, this framework is useful for some security purposes. Office of Real Time Location Tracking is a significant of transportation framework.

•   **Technologies Related to Location Tracking System [4]:**

1. Worldwide POSITIONING SYSTEMS (GPS) [4]

The Global Positioning System (GPS) is a functional framework including earth circling satellite fabricated steering framework. It gives it clients from one side of the planet to the other with 24 hours daily exact situating and time noticeable to the standard worldwide time in the three aspects. It includes three "fragments" in particular, the Control Segment, the Space Fragment and the User Segment. Right working of these three fragments prompts the exact and reliable working of the entire framework [4]. The Control Segment is otherwise called the fundamental control community as it is engaged with the transmission to the satellites. The Space Segment is made out of an assortment of satellites that circles around 20,000 km past the Earth. The User Segment is made out of the collectors that pay attention to the satellites at some random time. The User Fragment includes the beneficiary that is right now working furthermore, its connected radio wire. GPS doesn't work proficiently in indoor climate as GPS satellites have powerless signs which can't cross the dividers of structures. Henceforth, GPS isn't viable for indoor restriction. Indoor limitation requires high None Line of Sight (NLOS) and effective situating framework [4].

Now will discuss on IoT technology.

The Internet of Things (IoT) is an organization of implanted gadgets that are particularly recognizable and have installed programming needed to impart between the transient states. The motivation behind this review is to investigate discrete IoT security challenges relating to as of now conveyed IoT principles and conventions [5]. Of late, the whole organization area is going through an exceptional innovative insurgency. Robotization of organizations has been an intriguing issue that has been moving for a long while. Enhancing it is Internet of Things (IoT) innovation, which prepares for giving that component. The Internet of Things [5] is characterized as the between gadget climate developed by the gadgets that attention on three significant undertakings sending information, getting information, and handling got information. At first, neighbourhood actual gadgets associated with the web for constant information examination were considered being the IoT organization. With time-pass, IoT's scale has expanded itself from the neighbourhood workstation to Industrial IoT systems [5]. Examination deals with IoT portray the expansion of IoT in the field of–medical care [5], modern arrangement [5], business investigation, instruction, and so forth Starting at 2019, IoT, which used to work at more modest organization spaces, has updated for wide region organizations, thus have the dangers comparative with this is a direct result of the normal flood in IoT gadgets in a broadened climate.

- **Examination challenges [5]**

The main role of this examination work is to investigate the most recent security arrangements in the IoT. Other than this essential objective, sub-objectives contain distinguishing and portraying the most recent security hazards in the IoT [5]. Prior to that, address the new examination challenges in IoT- Heterogeneity issue [5], Between availability [5], Pervasive nature [5], Security principles issue [5].

Moving specialized areas like Artificial Intelligence as bunch based fluffy rationale modules [5], Machine Learning, and Software Enabled Networking [5] have turned into the new examination field for consolidating IoT. A striking improvement in IoT is the expansion of super lightweight conventions [5] conveyed for the centre working and security reasons also [5]. Examination works relating to IoT security challenges [5] cover an enormous region, and it is changing each day, with new provisos being uncovered consistently. Today, when we talk about IoT security, the principle accentuation is on the entrance control strategies [5], encryption techniques utilized for transient stages [5], and equipment explicit security arrangements [5], and SQL related info based assault controls [5]. Along these lines, our exploration stresses the steadily adjusting security points of view of IoT by giving IoT related security issues, legitimate definitions, order, and looking for the arrangement present in the current situation against them.

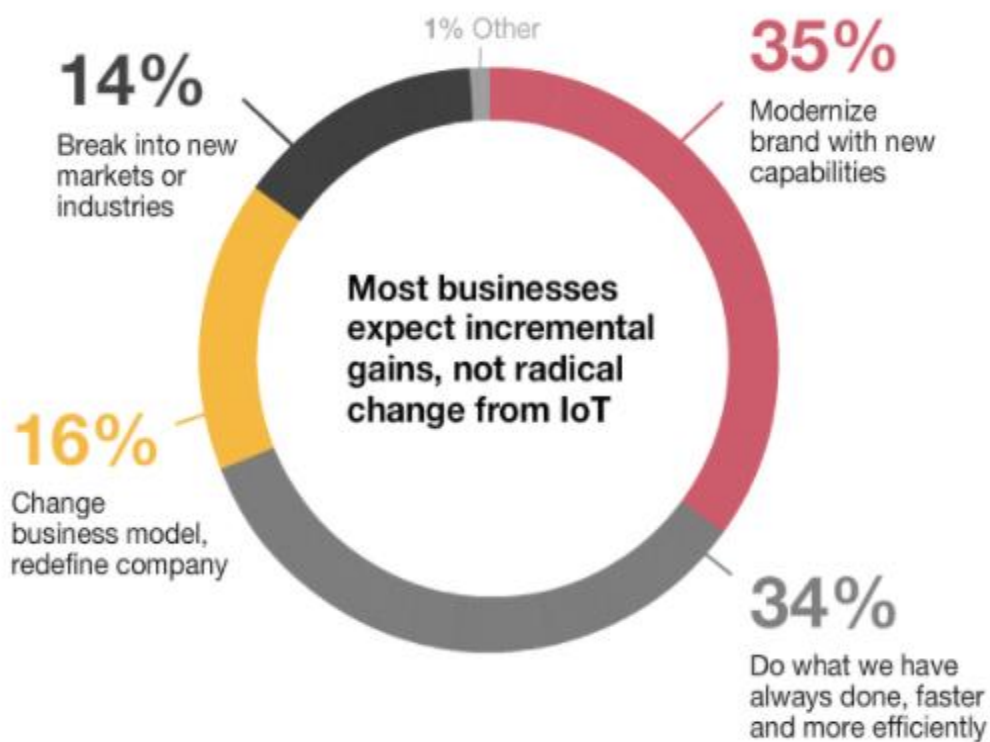Figure 1 depicts the broad application area of IoT.

Figure 1: Survey on IoT application area done in 2019

Review Of Literature

1.   Related works carried on tracking systems

In [7] the creators offered a concept of a programmed machine via way of means of utilising inventive and item primarily based totally factors for research of Soccer game's video. They applied types of calculations for instance a few low degree video coping with calculation what is extra, a few extra substantial degree calculation. Article highlights had been applied with Cinematic Features to similarly increase precision. Artistic highlights alluded via regular video shape and advent regulations like replays and shot sorts. Articles had been portrayed via way of means of their spatial factors, e.g., movements, shading, form, floor and collaboration. Three styles of outlines offered: 1) all gradual motion sections organized concurring to the Cinematic Features 2) all torpid motion quantities displayed via way of means of the Object Based Features. 3) all goals in video. They were given adequacy, effectiveness and heartiness of the shape for football video. In [8] the creators offered a dream framework which changed into geared up for selecting up, figuring out and following the item. The framework changed into exhibited this for following Hockey gamers. They applied calculations: mixture molecule channels and Adaboost. The mixture molecule channel is beneficial for several goal following because it relegates part of the mixture to each one of the gamers. Configuration troubles tended to on this paper for mixture molecule channel calculation had been, the remedy of the object leaving and coming into the scene and choice of the dissemination of the proposition. To defeat this trouble, they evolved the brand new proposition stream utilising a mixture version that covered records from the beginning fashions of each participant and the identity principle were given via way of means of Adaboost. They proposed the discovered Adaboost proposition dispersion which authorized them to hastily discover gamers coming into the scene and the sifting manner assists with tracking segregated gamers.

In [9] the creators added a smart manner to cope with certainly comply with and apprehend one of a kind quite blocked items in shifting and nonetheless conditions with a solitary digital digi-cam that would be nonetheless or shifting. They concept approximately the frame quantities of human beings for identity reason. In this paper, frame component signs had been discovered via way of means of operating at the range of powerless classifiers which trusted facet permit highlights. They applied a joint opportunity version which changed into formed via way of means of reactions of component finders which consist of research of impediments. The joined identity reactions furthermore, component identity reactions presented the views for following. Two following strategies had been offered: Data association and suggest shift. Instatement and stop of route each had been programmed and rely on consequences registered via the invention interplay. The framework should music human beings in among item obstacle and scene impediments with nonetheless or shifting foundations. They had finished an evaluation of the proposed method on one of a kind photos and recordings also.

In [10] the creators added a brand new engineering which incorporates of layers named as General Following Layer and Context Layer for 2 video games Squash furthermore, Handball. General Tracking layer gave a factor via way of means of factor file of a following interplay that's multipurpose for reconnaissance framework. Setting Layer related to 3 levels, to be precise 1) Initialization 2) Updation 3) Association. Setting Layer on this framework helped in apportioning new tracks to gamers, at the off threat that they impact. Setting Layer changed into supposed for questioning reason, for instance if any trouble occurs in any following level then putting layer intercedes. Setting layer offers the final international positioning framework.

In [11] the writers proposed molecule channel method with Mathematical shape for following contorted and shifting items. They likewise tackled the problem of impediments via way of means of remembering the form records for the manner wherein they decided the importance of weight (weighting step). The approach changed into attempted on 5 successions of recordings. There had been some impediments as method could fizzle 1) whilst protests definitely impeded 2) quandary to comply with extraordinarily excessive misshaped items whilst is going via obstacle. In [12] the creators added a web primarily based totally vicinity method for pretty a while following in thick visible reconnaissance conditions via a solitary digital digi-cam. They began out levels, specifically: Local Stage and Global Stage. The levels applied collectively that made this calculation endeavour to music down each neighbourhood perfect route and global perfect route for all items. In neighbourhood level, they applied a molecule channel with onlooker dedication which manages midway article impediments which changed into applied to create strong music shall we. In global level, they accumulated discovery reactions from the worldly sliding window, so they may control estimation that changed into delivered approximately via way of means of complete obstacle of items to get ability music shall we. They associated each of those music shall we (Potential and dependable) via way of means of the Hungarian calculation on a to a few diploma modified pairwise music shall we association price framework to get global perfect dating for tackling records association trouble. They carried out this method at the character taking walks class.

Some of the related work carried on vehicle tracking system is depicted in table 1 below [13]:

Author/ Title/ Publication	Technology used	Research Gap
1) Akshatha S.A, "GPS based vehicle tracking and monitoring system", Volume: 04 Issue: 04	Apr - 2017.	1) GPS technology. 2) Raspberry Pi technology.	1) Only the comparison result can be displayed by the display unit, no map was shown. 2) Need more input for comparison.
2) Hazza Alshamisi, Veton Këpuska, "Real Time GPS Vehicle Tracking System", Volume 6, Issue 3, March 2017.	1) GPS technology. 2) GSM technology. 3) Web technology.	1) Fully web-based. 2) Unable to see location in case of internet failure. 3) Difficult in hardware implementation.
Author/ Title/ Publication	Technology used	Research Gap
3) Jessica Saini, Mayank Agarwal, Akriti Gupta, Dr. Manjula R, "Android app based Vehicle tracking using GPS and GSM", volume 6, issue 09, September 2017.	1) GPS technology. 2) GSM technology. 3) Microcon-troller.	1) Due to a certain limitation in hardware, app location on the app has an error of approximate-ly 10 meters. 2) Hardware requirement costly.
4) Amol Dhumal, Amol Naikoji, "Survey Paper on Vehicle Tracking System using", Volume 3 Issue 11, November 2014.	1) GPS technology. 2) GPRS technology.	1) The tracking device is not internally built on the vehicle.

Table 2 covers the survey of tracking system based on wireless sensor networks [4]:

Survey Content	Reference Number	Published Year	The Related Knowledge
The whole process of target tracking	High	2016	Detailed (The whole process of tracking, the metrics for analyzing algorithms, the requirement of tracking based on WSNs)
The management of energy for target tracking	Medium	2012	Brief
The prediction algorithms used in target tracking	Low	2014	Brief
The target recovery techniques in target tracking	Low	2016	Brief
The security of target tracking	Low	2014	Brief

Table 3 covers the survey of tracking system based on target tracking system [4]:

Taxonomy	Reference Number	The Newest Reference	Standard of Comparison
Instrument-assisted method Mode-based method Tracking optimization method	High	2017	Comprehensive (tracking precision, cost, complexity, note, the characteristic of target)
Network structure Problem formulation Number of targets Type of target	High	2015	Common (prediction, energy management, target recovery)
Network structure Prediction-based Type of objects Type of sensors Number of targets Recovery	Low	2015	Only summary no comparison

The fundamental thought of any satellite situating framework is to work out the distance between a satellite and the current area of the GPS unit. The situation of each satellites is known. Utilizing the determined separation from four satellites, one can limit their present situation to precisely one place on earth's surface. The exactness of the situating relies upon how precisely the distance is estimated and how definitively the situation of the satellite is known. The herald of the current Global Positioning System (GPS) began as a military project in the last part of the 50's. The initial two endeavours were made by the Navy. In 1959, Transit was the first satellite-based route framework. It utilized seven low elevation polar satellites and radio transmissions to acquire moderately precise data about the situation of individual boats. Travel utilized the Doppler Effect of radio frequencies to gauge distances. The Doppler Effect didn't yield high precision, was restricted to specific regions, and required ceaseless estimations. The second framework, the limitation, was presented in 1964. The limitation framework utilized two space satellites furnished with nuclear timekeepers, which gave more exact two dimensional situating. This framework was quick to utilize the time it takes the radio transmissions to arrive at earth to quantify the stance [15].

2. Related works carried on IoT technology

• Researchers namely, Vinayaka and Roopa had projected a structure aimed at observing then monitoring the grain conditions. Grain factor called stockpiling house remains essentially towards supply secure accumulating circumstance and to hold up with nature of set aside thing. Grain hardship happens with the guide of negative natural specifications and from the exercise schedules of frightening little animals and microorganisms [16].

• The standard life sized model proposed for grain accumulating gadget contained two areas, one is the host PC what gathers Grain nearby climate for example Sensor data, it approaches and decide of grain circumstance, the distinctive one decline stage control terminal in the storage facility/station with grain records getting. Hence, the proposed structure comprises of the usage of ARM7 processor, LPC2148 and an assortment of sorts of sensors. The limits like temperature, wetness and carbon dioxide charge is demonstrated on the interface. Expecting the attributes are over sure confine conditions, controlling strikes are made actually [17].

• The maker Can Burak Sisman and Selcuk ALBUT states that, it is trying to work on the idea of set aside grain then again holding up with its fundamental astounding must be conceivable. At the factor when country of set aside grain gets going developed spoiling, it is ordinarily the blend eventual outcome of unmistakable organization exercise schedules that involve basic country of grain,temperature and suddenness development, air course and gazing at grain condition. Grain shop magnificent on the off chance that they are cool, dry and clean [18].

a. Issue declaration

• Throughout the capacity time body (e.g., air dissemination, drying, fumigation, overseen environments, grain protectants) [19].

b. Targets

• All through the particle amassing, heat, wetness and carbon dioxide main focus remain broad barometrical components that know how to affect the idea of the set aside grain through the internal the warehouses and circulation focuses. The set up methodologies are controlled to just looking at the temperature and tenacity requirements which are very in converse as extraordinary components must be checked and found uninhibitedly for including to their beneficial accumulating and backing [20].

The broad area of IoT application is depicted in the figure 2 below:
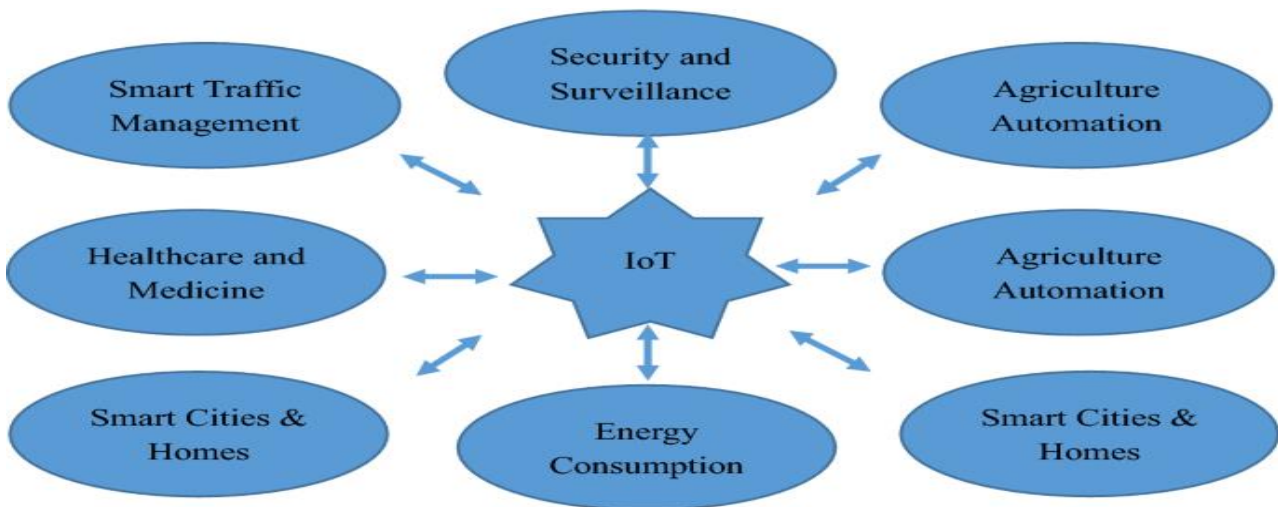

Figure 2 outlines not many of the application areas of IoTs possibilities.

Different significant IoT projects have assumed responsibility over the market in most recent couple of years. A portion of the significant IoT projects that have caught the greater part of the market are displayed in Figure 3. In Figure. 3, a worldwide conveyance of these IoT projects is displayed among American, European and Asia/Pacific district. It tends to be seen that American mainland are offering more in the medical services and savvy store network projects though commitment of European landmass is more in the brilliant city projects Figure 3 shows the global distribution of IoT application in European countries.

Global Distribution of IoT Projects
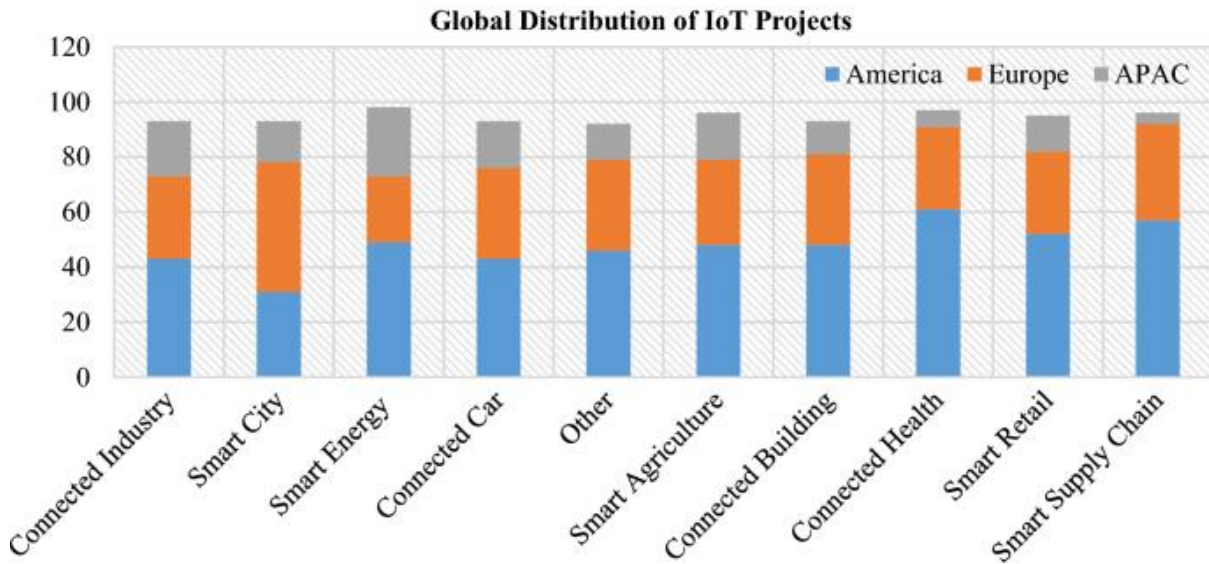
Proposed Methodology

The steps involved in proposed methods are listed below:

1)   A motion sensor connected to the bus ignition engine.
2)   Motion sensor will be activated once the bus starts.
3)   To motion sensor, Raspberry Pi will be connected, in which top 3 mobile numbers will be stored.
4)   When the motion sensor starts working, through Raspberry Pi, the mobile phone can be connected.
5)   The bus can be tracked through a local application installed on the phone or through google map.
6)   When the bus engine is off, the location of the bus can be traced based on last location.

The diagram of the entire system is depicted below:
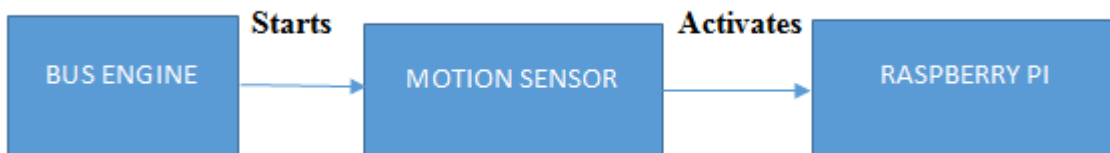
Components used in the proposed method:

1.   Motion Sensor

Movement sensors are usually utilized in security frameworks. They work dependent on a wide assortment of standards and are utilized in a wide assortment of uses. Normal utilization could be in the outside entryways or windows of a structure for observing the region around the structure. After recognizing movement, they produce an electrical sign dependent on which a few moves are made. n the proposed framework, the movement sensor will be associated with Raspberry Pi which will be thusly associated with programmed locking framework sensor of the vehicle. At the point when the movement sensor gets initiated from the sign sent by motion sensor, it looks for development of the vehicle and sends signal to Raspberry Pi.

2.   Raspberry Pi

The last and the most important device of the entire network is "Raspberry Pi" which is called as "mini-computer". Image of Raspberry pi is shown below:

Conclusion

Tracking systems are very useful in identifying the location of thieves, kid nappers or the people carrying out the illegal activities. There are many technologies are employed in designing these tracking systems such as GPS device, different sensors or mobile phones and locating the person can be done using google map or application. Same devices can be used to track vehicles also. Vehicle tracking will be useful to identify where is the vehicle especially in case of public transport. This can be utilized so that people can save their timings to avoid the long waiting. The paper has proposed a new method using motion sensor and Raspberry Pi where the tracking of the bus is done through mobile phone from a remote place.

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