LI-FI IN VEHICLE IDENTIFICATION

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Abstract: **In recent times, the vehicle theft has emerged as one of the major problem that is happening. The purpose of this paper is to reduce the risk of the vehicle theft by following the method of number plate detection using the on-going technology of Light Fidelity. This also ensures faster mode of tracking the stolen vehicle with more preciseness. This paper also creates the awareness about the presence of speed bumps to prevent accidents.**

METHODOLOGY: Major concepts in this paper include the use Li-Fi and image processing. The image processing is carried out to recognize the vehicle's number plate (using Smearing algorithm) and Li-Fi is employed to transmit the digitised version of the number plate to the existing database for verification. Li-Fi technology provides prior information about the speed bumps.

RESEARCH LIMITATION:

- **Range coverage can be increased in the future enhancements.**
- **Signals & headlights must be in working condition.**

ORIGINALITY: Though there are solutions found for recognising fake number plates of a vehicle problem, there was not any specification given about the correlation technique. Li-Fi marks the use of efficient new technology for the data transmission and its' application to identify stolen vehicles make it independent from other technology. An immediate intimation is also given to the owner and to the nearby police station providing an easy way of knowing the where abouts' of vehicle stolen. The other salient feature in the proposed work is for all the vehicles in common. It is all about giving a notification well in advance to the vehicle drivers about the presence of speed breakers on the way.

FINDINGS:

- **Identification of stolen vehicles**
- **Identification of fake number plates**
- **Notifying the owner and police about the stolen vehicle recent location All the above helps in early recovery of stolen vehicles.**
- **Identification and intimation of speed breakers well in advance there by saving lives.**

Keywords: **Li-Fi, image processing, smearing, vehicle theft, awareness, vehicle number plate, fake number plates.**

1. INTRODUCTION

The emerging technology is taking the entire world towards automation in all the fields. Li-fi contribution is also significant. Harald Haas was the first person to introduce this fabulous "wireless data from lights" in the year 2011[2] that is Light Fidelity (Li-fi). Lifi is a wireless technology and is a part of visible light communication.[9]. As visible light is used, beam formation becomes simple with optics [8].

With automation in place, slowly Wi-fi usage is being replaced by Li-fi. The difference between Wi-Fi and li-fi is that Wi-fi uses radio waves for data transmission but Li-fi uses visible light[2]. Li-fi is the optical version of Wi-fi.[1]. Li-fi is faster than the Wi-Fi technology and so even if n number of devices are connected through Li-fi, the speed of Li-fi does not get reduced[8]. About 224Gbps is the speed for the data transfer using Li-fi [3]. It transfers data over the electromagnetic spectrum. Li-fi offers advanced connectivity at a reasonable price. Li-fi gives brilliant way of broadband

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access. Lifi data rate rely on the signal standard of the device[12].Therefore li-fi labels for the fastest, cheapest, full duplex, high performance, reliable, dimmable, improves data density, safe and secure data transfer. Here the sampling rate is doubled, includes multiple access, has higher bandwidth, susceptible to electromagnetic interference [4]. Li-fi provides confinement, [8] RF interference and a wide spectrum. It does not require any additional energy or frequency up conversion [8]. Its spectrum is globally blended and un licensed. The main advantage is that it has no capacity limitations [8]. LED's are at transmitters and photodiodes are the receivers.[1] The communication between them takes place i.e. the data from the transmitter reaches the receiver through photon particles which acts as the carriers.

In this world of emerging technology, there are plenty of problems too which are emerging along with the technological growth. In the fast moving world transportation plays an inevitable role. The usage of vehicles is exponentially growing and so once the vehicle is lost its becoming a herculean task to find them. The main identity for a vehicle is its number plate and its chassis number. Use of fake number plates is the major reason for the theft rate to increase. During the yester years, there are many solutions that have been proposed but still vehicle license plate detection still remains as a challenging task[11]. In India number plate detection task becomes much difficult due to variation in plate model [7]. Li-fi has emerged as one of the amazing one which could help in automobile's number plate identification.

In this paper vehicle theft is dealt with using modern technology. As far as automobile is concerned its number plays a vital role in its recognition. These number plates are being changed and the vehicle is stolen. This is becoming a usual scenario in several instances at several places. As the population increases the number of vehicles also increases which in turn increases the theft rate. In this paper an effective methodology is proposed to forbid the theft of automobiles with fake number plates using the Light Fidelity (Li-fi) and image processing. Along with image processing method and lifi technology, a method is proposed to prevent accidents using notification about the speed bumps using Li-fi. License plate recognition (LPR) is used by the police forces to check if the vehicle is registered or not. It uses infrared rays which is harmful [10].

2. LITERATURE SURVEY

Mrs. Kshitija Suhas Kapre has designed a green corridor system for automobiles which are in the urge to go i.e ambulance need not wait for the green signal, the traffic signal automatically changes green when the ambulance arrives and remains green it crosses the signal [1]. Gopal S. Gundu ,Sandeep R. Verma have proposed that if lifi technology is implemented in railway stations the number of routers used can be reduced and there will be a commom access point for every station.[2]. M.Bharathi, R.Maheswari, R.Pavithra, M.I.Anju have developed high speed data transfer mechanism using lifi technology. This could offer a dramatic speed for data transfer even in areas like power plant.[3]. Nilufa Yeasmin, Rianon Zaman and Israt Jahan Mouri have developed a prototype in which they have used Arduino, PIC Microcontroller, Light-emitting diodes, ultrasonic sensor and lifi technology to avoid accidents and to check the speed limits of the vehicle.[4]. Amr Badr, Mohamed M. Abdelwahab, Ahmed M. Thabet, and Ahmed M.Abdelsadek have used license plate recognition, plate region extraction, segmentation, neural networks, OCR for identifying car number plates automatically.[5]. Cosmo H. Munuo,Dr Michael. Kisangiri,Eng. Prof. Nerey H. Nvungi have used MATLAB R2012b Simulation software with Image Processing toolbox and an better algorithm to extract characters from the number plate and does template matching.[6]. Mayank Yuvaraj has included the potential application of lifi and a general overview of lifi technology.[9]. Linda M.Merola,Cynthia Lum,Breanne Cave,Julie Hibdon have designed a "continuum of LPR uses",which gives a better way to understand the lawful problems on LPR(license plate recognition).[10]. G. Naveen Balaji & D. Rajesh have proposed a License Plate Detection, Recognition(LPDR) model which plays a significant role in detection of number plate.In this they have used 4 main steps such as pre-processing, License plate region extraction, characters segmentation and each character recognition in the licensed number plate.[11].

3. EXISTING WORK

LiFi is a reliable backbone connectivity.[1]LiFi is not a line of sight[12]. LiFi helps in avoiding collision and improves safety. Safety during the drives has become an important need in today's world because there are number of abnormal accidents occurring these days[11]. The awareness that our upcoming technology creates for a safe and comfortable drive is discussed. For that purpose head lights, tail lights of vehicles are fixed with led so as to enable communication between vehicles. The communication is enabled via lifi technology. This helps to give intimation for the vehicles to slow down

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and so many accidents could be prevented. Intimation can be given by calculating the distance between the vehicles. Spacing between the automobile can be known by using the active ultrasonic sensor [4]. These sensors, measures the distance is capable of producing high frequency audio waves. The echo which is received to the ultrasonic sensor is taken into account. The time taken for the transmission and reception of the echo is the distance between the vehicles. For this work a minimum distance between the vehicles is pre-set. The ultrasonic sensors always calculate the distance between the vehicles and that distance is compared with the pre-set distance[4]. If the distance calculated by the sensor is less than the minimum distance a intimation is sent to the vehicle to reduce the speed. This intimation is sent through head lights of the automobile. The sent information is decoded by the arduino microcontroller using the lifi technology.

Li-fi can be employed in many fields for better perception. Li-fi is used to give the information about climatic conditions, speed limits, road condition. The road conditions and speed limits can be informed to the vehicles when all the indication boards are fixed with led. For the convenience and to save time, vehicles are alerted about the traffic blocks so that people can take an alternative route. This is possible by fixing led on the timer board which is present near to the signal.
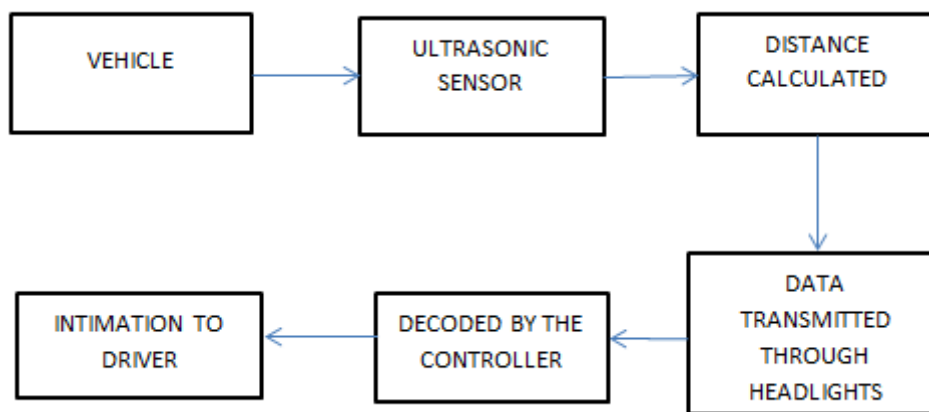

Figure 1: BLOCK DIAGRAM OF EXISTING SYSTEM

The figure1 explains the working of the existing system. The distance measured by the ultrasonic sensors is transmitted from the headlights and taillights through the li-fi and decoded by the controller which helps in speed concerns to be maintained.

4. PROPOSED WORK

Road safety and traffic management plays a vital role in our day to day lives. As the number of automobiles is increasing the theft rate is also increasing. We will need to take some effective methods to solve this increasing theft rate. The latest and fastest upcoming lifi technology is used to reduce the stealing rate. LiFi technology can change the world, especially it can be used to safe guard the vehicles against vehicle theft. In this paper an efficient solution is proposed to identify the stolen vehicle using the high speed LiFi technology. Lifi mainly uses Light Emitting Diode(LED's) at the transmitting side and a photodiode at the receiving side. LED's switch faster than that of man's eyes which cannot detect their ON and OFF states very fast. Their switching speed is nearly in nanoseconds which make light visible to our eyes. This switching allows them to send the data by the help of binary codes. When the led is in ON state its binary code is 1 and when it is in the OFF state its binary code is 0. Modulation takes place in a very quick manner that it becomes invisible to human eyes. As the LED keeps changing it state, it is possible to encode the data in the visible light which gives 1 and 0. At the receiving side there is a data convertor. The received data signal is transformed into the actual information by the use of photodiode. A photodiode is capable of identifying that modulation. Therefore the way of transmitting the data through light without the use of wires is called as light fidelity.

LED's and photodiodes play an inevitable role in lifi technology. There is an LED at the transmitter and a photodiode or photo detector at the receiver. A photodiode or photo detector is used for the conversion of light energy to current. This method can achieve Visible Light Communication. The visible spectrum is the part of the electromagnetic spectrum. Their wavelength ranges from 380nm to 780nm. LiFi emerges as a portion of VLC. lifi communication helps for both lighting and wireless communication using led.

In the proposed system, as a first step, each vehicle is assigned a unique id. The vehicles chassis number is related to its number plate details and stored in the database along with its corresponding unique id. The owner's details like their name, mobile number, permanent address, etc are also stored.

In addition the vehicles head lights and tail lights play a major part. The lights of the traffic signal has a photodiode (receiving side). Head and tail lights of an automobile are enabled with led(transmitting side). Using the LiFi technology the head lights and signal lights communicate. Due to this communication data transmission take place i.e here the number plate details are sent to the receiver. As a result when the vehicles cross the signal, the unique code along with number plate details are transmitted. The radius for the communication takes places is within 10 metres. The number plate details can be captured using image processing and sent to the database. A small hidden camera is placed at front and back of the vehicle in the slot above the number plate. Using image processing the number plate is scanned and the data reaches the signal light through head, tail lights via lifi technology. The data which is received is verified with the existing data present in the database. Thus the received unique id along with the number plate details is compared with the details that are already available in the database. If they do not match, intimation goes to the police station and to the owner of the vehicle about the forgery. The information about the signal which the vehicle has crossed is also given to them. This makes a great deal to trace the stolen vehicle. This also paves an easy way to identify the vehicle and make proceedings against them though law.

The proposed work also uses LiFi for avoiding vehicle accidents. Speed bumps may also be a reason for the accident if they are unnoticed by the people. Most of the times drivers ride at their maximum speed and they do not see the speed breakers ahead. This causes inconvenience. So if led's placed on either sides of the speed bump, lifi technology ensures that the head lights of the automobiles communicate with the led on the speed bump. During this communication data is transferred and we get information about their presence. This could alert the people who are driving. The information about the speed breaker is sent to the automobile when they are 10 metres apart.
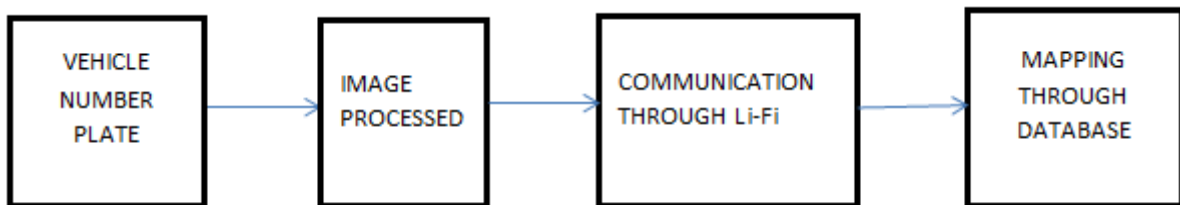

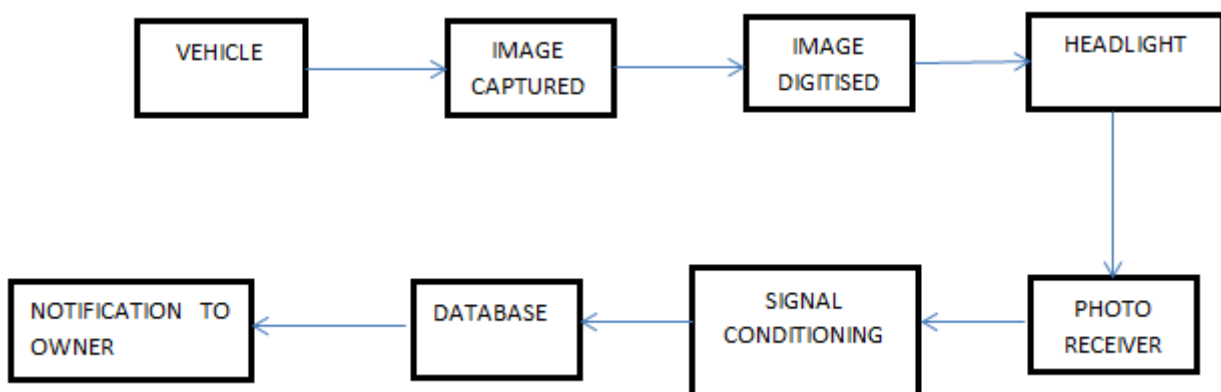**Figure 2: OVERVIEW OF THE PROPOSED WORK**

Figure 3: FUNCTIONAL BLOCKS OF THE PROPOSED WORK

Vehicles number plate is captured and it is processed, the information is given to the photo receiver via the headlights. The photo diode is at the traffic signal. The signal is verified with the database and if they do not match intimation is given to the owner of the vehicle and to police.
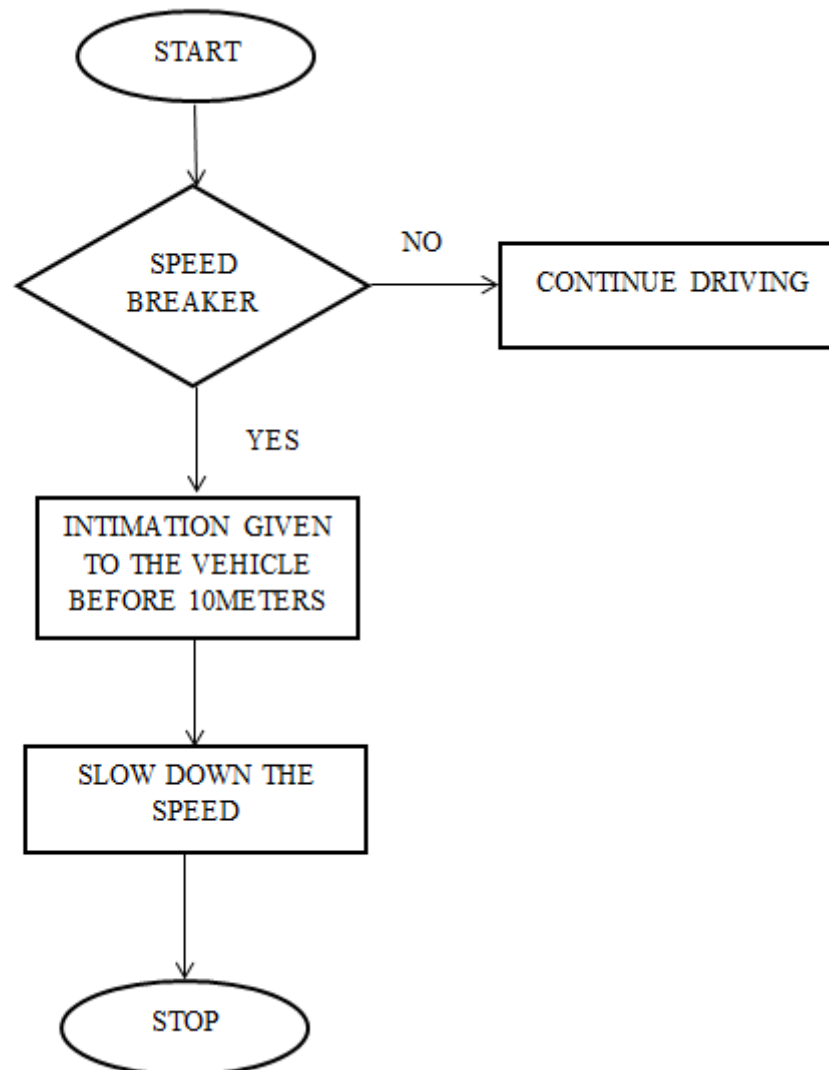
FIGURE 4: FLOWCHART

ALGORITHM

Step 1: Image of the number plate is taken.

Step2: Firstly borders will be cropped.

Step3:The grey scale image will be processed horizontally.

Step 4: After the horizontal scan, further it is vertically scanned.

Step 5: Both the scans are together called smearing algorithm.

Step 6: After those scans morphological image processing takes place.

Step 7: Only the required details are taken and the space between the letters is omitted.

Step 8:   Then the data is sent to the signal through headlights.

Step 9: The number plate details and the unique id is sent to database.

Step10: The matching takes place by comparing the unique id and the number plate details with the details stored in the database.

Step 11: If it is a stolen vehicles intimations are sent to police and vehicle owner.

5. CONCLUSION

Today's world, in every field, is filled with technology. There are a number of problems arising in this developing world day by day with technological development. The vehicle being stolen by changing the number plates has become a harder task to find. Thus our proposed system helps to find them using the lifi technology and image processing. Even the speed bumps are one of the causes for loss of lives when unnoticed. Using the lifi technology, awareness about the speed breakers can be given at about 10 m distance.

6. RESULTS AND DISCUSSION

Vehicles are increasing day by day as the population hikes. Use of fake number plates becomes an herculean task. Therefore this experiment can be a best solution for the identification. For the experimental testing purpose a sparsely populated area is taken into consideration. The parameters taken into consideration for this experiment are listed below.

Number of vehicles considered	3
Speed of lifi	224gigabytes per second
Image Processing algorithm	Smearing algorithm
(Number plate)	
Mapping	Data obtained from Signal with database
Range of lifi	Within the light beam coverage

The experimental results deduced were to verify the originality of the number plates. Detection can be done quickly. Just within nano seconds it can be identified if the number plate is fake or not. If a fake number was detected, intimation to the owners and police is given within 1 minute. Lifi work with the same speed even when number of devices are connected, this can be efficiently used even in densely populated area where vehicles are plenty.

Avoiding accidents are vital. Experiment was performed to reduce the accidents occurring due to Speed bumps. Normal height of the speed bumps is 10cm.Its curvature radius is 17m and 3.7m wide. Taking into account these parameters, the person who is driving the vehicle is intimated about the speed breaker. The distance is 10m before the speed breaker. Intimation is given in the form of alarm in the vehicles. The communication between headlights and transmitter takes place before 10m and an alert is given to the drivers within nano seconds.
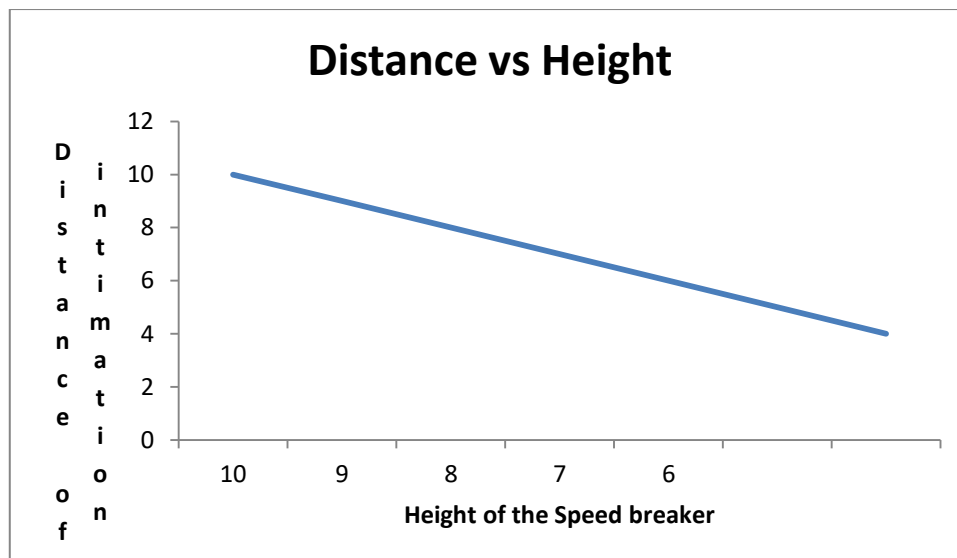

FIGURE 5: DISTANCE VS HEIGHT

The above fig.5 explains the distance vs height. According to the Indian Roads Congress10cm is the height of speed breaker.X-axis contains height of speed breaker and Y-axis contains distance of intimation.As the height decreases,the distance of intimation also decreases.
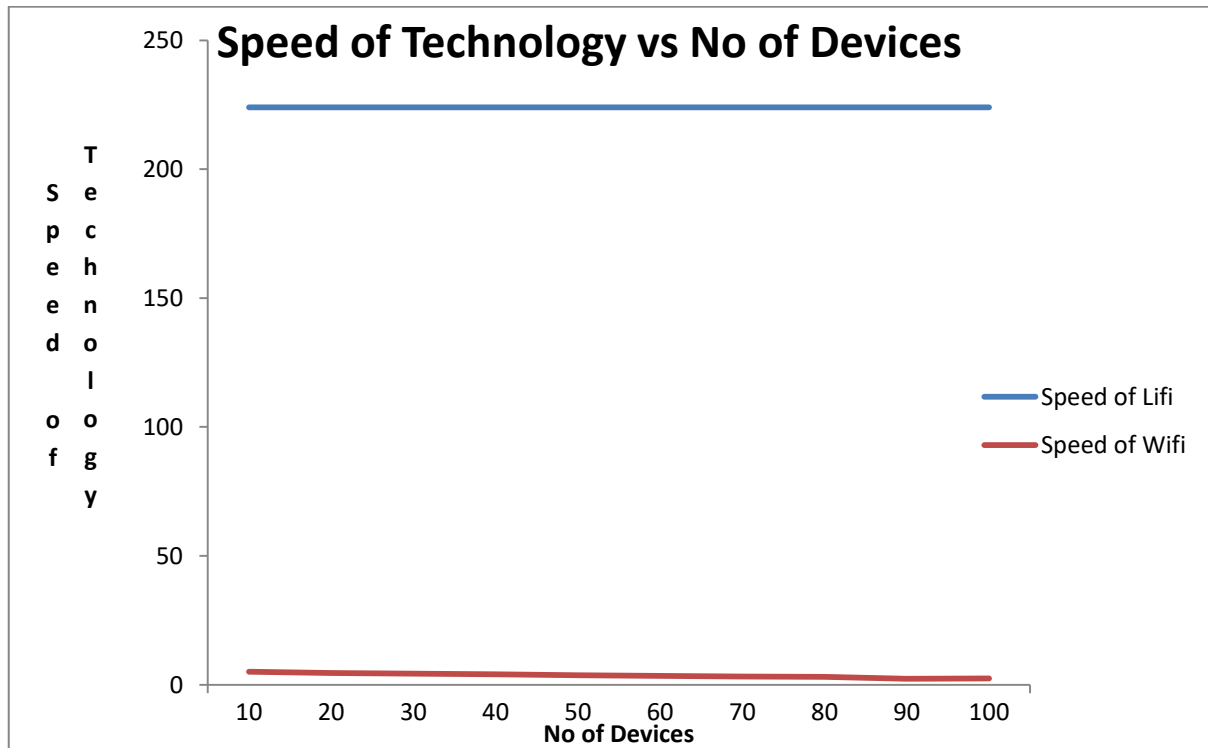
FIGURE 6: SPEED OF TECHNOLOGY VS NO.OF.DEVICES

Fig 6 explains speed of technology(wifi,lifi) vs no.of.devices.X-axis contains no.of.devices and Y-axis contains speed of technology.This graph shows that lifi has got the better performance because of its speed.

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