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IOT Enabled Smart Hostel: A Futuristic Perpective

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Abstract: ***In recent times we have seen tremendous development in smart devices and services. The Internet is also becoming cheaper day by day and the data rate is also increasing with the passage of time. This has increased the demand for more and more device to be connected to the internet. Smart home, smart buildings and other IoT based frameworks are becoming popular today. There are many problems in real life which can be solved using the internet. We have lived in the hostel for more than five years and based on our observation we had come up with some of the major problems which are common to all. And as tech savvy people we had put our thought process on how to solve these problems using technology. In this paper, we are focusing on problems faced in hostels and proposed solution for those problems. We have developed a conceptual framework "Smart Hostel" through which we can solve all the major problems faced in the hostel.***

Keywords***: IOT, Smart Devices, Smart services, Smart Hostel, Database, Sensor.***

I. INTRODUCTION

Internet of Things, as we probably are aware today, had not been around for quite a while. It was not until 1999 that Kevin Ashton was considered as the previous of the idea of Internet of Things (IoT). From that point forward, the IoT has advanced immensely from the individual visitor space to the substantial plant floor by either utilizing conventional innovation, for example, Radio Frequency Identification (RFID), Wireless Sensor Network, Bluetooth or exploiting the Cloud registering offices accessibility. It has offered us a Smart City including keen home, savvy city and clean-living condition. The term of IoT is a straightforward idea that the Internet advances from a path for gadgets to be smarted and interconnected. These gadgets can accumulate prepared information and settle on choices fittingly. (Vinh, 2014)

In the Internet of Things (IoT), assortments of things (i.e. objects) around us have Internet addresses and connect with each other to accomplish shared objectives. (Su, 2014) These articles ought to have the capacity to serve various applications, as opposed to a solitary devoted application. (Su, 2014) Realizing the vision of practical IoT applications requires the improvement of IoT innovations with new ways that will empower things and articles to end up plainly more solid, stronger, more self-ruling and more intelligent. (Kyriazis, 2013) According to CISCO, amid 2008, the number of things associated with the Internet surpassed the number of individuals on earth and by 2020 there will be 50 billion, molding a rich computerized condition. (Kyriazis, 2013) The IoT world Forum of 2014 anticipated that there is a tremendous market for IoT arrangements developing from $1.9 trillion out of 2013 to $7.1 trillion of every 2020. (Vinh, 2014) Sensors, smart settled and portable stages (e.g. cell phones, tablets and home doors), huge scale cloud frameworks and other system empowered gadgets will all need to participate and collaborate to make some incentive crosswise over numerous areas in the smart biological community. (Vinh, 2014)

Sensor Markup Language (SenML) is a rising standard for speaking to sensor estimations and gadget parameters. As an industry-driven portrayal, SenML is taking a more imperative part in IoT spaces and applications. It is not an exclusive information design; consequently, it empowers great interoperability among IoT gadgets from various sellers. Additionally, SenML underpins smaller configurations, i.e. JavaScript Object Notation (JSON) and Efficient XML Interchange (EXI) format for the most minor gadgets. JSON may be the most broadly utilized punctuation for SenML. At the point when gadgets have constrained correspondence assets, EXI can be used. (Su, 2014)

Smart City activities in India: according to the Census report in 2011, 63% of India's GDP originates from the urban zones and just 31% of India's population is dwelling there. Population living in rustic territories began moving to the urban range for a superior way of life. By 2030, the nation is expecting 40% of the population will be there in urban areas and that will contribute 75% of India's GDP. For obliging this urbanization, improvement in foundations in wording physical, financial and social are obligatory. Both government and private parts as of now started some program by putting resources into this territory. In 2014-15 Budget, the government of India allocated 70.6 billion for keen city ventures. Savvy Solutions for a Smart city can be arranged in view of the administration parts. Water and Energy administration are the key territories of core interest. Smart Meters (which can screen and deal with the utilization and appropriation), water quality checking, spillage recognizable pieces of proof and so on are few testing arrangements in the Indian situation. Brilliant lattices, sustainable source vitality administration, green building and so on are a few arrangements going under Energy administration. Smart Parking, insightful activity administration, coordinated multi-modular

transport can convey Smart transportation to the city. Savvy squander administration, air quality checking and commotion observing framework can add more esteems to the keen condition. (Patnaik, 2015)

The Internet of Things is turning into the new calculation condition with interconnection of "things, for example, programming and data administrations, gadgets, gear and sensors. They can speak with each other by means of the Internet. The future development of IoT based applications is anticipated to be colossally high. Consolidation of informal organizations and pervasive processing innovations in IoT empowers people and gatherings of individuals to connect with consistently with nature. The solace that is experienced through the inventive advancements in IoT was with the costs of protection. For example, handling the sensor data of houses that their corridors and entryways are outfitted with light and magnet sensors can surmise the format of the building which may be misused in malignant targets. In another case, a message is posted in a client Facebook page after they appear at a store and the video sensor gathers their photo. Face recognition administrations distinguish their name and RFID labels find the store. Through this, the general population are followed as well as their area is imparted to other individuals in their system. Regardless of the work of protection instrument, for example, anonymization, utility trade-offs, intermediary based methodologies, and building up more significant and solid lawful limitations on information extraction and distinguishing proof, security still is a noteworthy test in IoT. Some of these models assume a specific setting for situations. Some others are not tending to the inclinations of substances and they depend on data increase as it were. Additionally, some security insurance models hold fast to a solid supposition of having put stock in "things" in the earth. (Samani, 2015)

In this paper, we are going to present a prototype of Smart Hostel in which every device present in hostel premises are integrated and connected to the internet. We will use sensors as well as databases to integrate devices and provide smart services to the users. This prototype can be implemented across all the hostels in this world with some modification. Around 29 problems faced by hostel residents are covered in this paper and consequently, the proposed solution is given for the same.

II. LITERATURE REVIEW

An effective way of communication can be established for interconnection of systems for a better user experience by using various sensors such as digital bio sensing surface, ECG, tablets, smart phones which are a result of research and development over the years. Even in the medical areas for example in hospitals, computerized information system also known as Hospital information system is being used for the purpose of monitoring and other important information of the patients. (Thakare, 2013)

It is a practicality that smart multimedia devices which are made for homes and smart offices home offices (SOHO) and their implementation are vulnerable and the threat that hovers over these devices being used in offices and homes is secure operations and information of the networks in which these operate. These devices that are being used are utilizing commercially available technologies easily available for seamlessly carrying out the operation on such devices and also those technologies are also available which can be tailored as per the usage of the device. (Kavalarisa, 2015)

It has been found that various decentralized management mechanisms which target IoT based systems have been found and are functional as well which intend to exploit millions of devices and also various architectures have been designed that shall allow the learning based on the experiences of the others such as situational knowledge acquisition, analysis for better understanding of the conditions which would affect IoT based behavior. (Kyriazis, 2013)

The application of semantic web technologies over IoT has created a huge domain base of smart apps and services. However, there is a challenge in converting semantic representation and data formats used in IoT devices but sensor markup language is a solution to overcome this challenge which helps in the representation of device parameters as well as measurements. These days sensor markup language is being accepted by more and more vendors. (Su, 2014)

One of the most crucial emerging infrastructures is Smart Grid which is also considered as one of the largest IoT networks and consists of classical augmented power grids integrated with renewable energy. It involved a large number of objects and devices such as smart sensors, actuators, smart appliances and much more along with the other communication infrastructure which is either private or public, but again security is posed as a major concern in adoption and implementation of the IoT based networks and smart grids. (BEKARA, 2014)

Mobile cloud computing and It has drawn the attention of many technological experts, but the integration of the two can be done using service architectures focused on mobile apps, sensors as well as cloud computation. There are many examples of such scenarios but One of the most common examples of such integration is smart homes. (Vinh, 2014) For the purpose of effective utilization of water as a resource, smart water management system plays a very important role in smart cities. The use of various technologies and platforms enable smart cities to have the smart environment. One smart part of smart water management system is smart water monitoring system. (Patnaik, 2015)

A subsystem that consists of components such as neural network etc. forms a part of smart homes and the best features of a smart home are which are necessary as well are the self-adaptive system for personal comfort which includes the combination of building specifics, user profile and external influences lead. Smart homes would need an architecture which will help to implement service on hardware and virtual devices. Automation is the key step in order to implement smart functionalities for supervision and training of other components for the purpose of live feedback. (Teich, 2016)

For the purpose of monitoring physical environmental conditions, wireless sensor networks are used in addition to various other applications deployed in various fields. One such example is monitoring of air pollution which uses WSN nodes for continuous monitoring of air pollution around the city as well as of the pollution caused by public and personal transport. (Jamil, 2016)

Smart phones and gadgets are the new ways for the purpose of interconnection for humans. IoT is another field where cars, public venues, houses, social systems are forming a network of connection. New standards are being created for all these connected systems and the existing standards are also evolving. This shall change the way life is being lived by today`s humans. (Elmaghraby, 2014) In the field of education, educational buildings provide an important aspect of monitoring and management of buildings as it takes care of both the energy and educational issues. Real time monitoring can be provided by hardware IoT infrastructure for various school buildings and this can be done only by following an open design approach and good hardware components which communicated well over open surfaces. (Pocero, 2017)

Cooperative distributed systems (CDS) are based on IoT modelling which does the work of analyzing and modelling of privacy concepts and concerns. 'Sensitive information' is the tag given to privacy protection and this application forms a part of the framework which works for CDS. This is shown by extending CNP (contract net protocol) for the support of privacy protection for CDS. (Samani, 2015)

Technologies such as IoT and cloud computing should leverage the smart farming-focuses on information and communication technology in cyber-physical farm management cycle. This can be done by the introduction of robots and artificial intelligence in the field of farming by using the tools such as big data for better decision making. (Wolfert, 2017)

For better communication and interaction with the computer systems various wearable devices such as bracelets or wrist watch capable of performing functions and operation from their current locations and receive notifications accordingly have been developed. These devices reduce the technological gap by automating systems which are very easy to adapt for daily activities and for the purpose of interaction with the environment and people using the devices implanted in that environment. (Bonino, 2012)

A new technology called Bluetooth smart enables wireless communications in the apps dealing in the fields of healthcare, fitness, beacons, security, and home entertainment industries. By making use of electronic tags, automatic wireless identification is facilitated via the Bluetooth smart enabled device. One of its application is taking students attendance in classrooms which eliminated human errors and saves the time for manual attendance and provides statistics for further decision making. (Lodhaa, 2015) The smart needle is a healthcare product functions by identifying the issues when placed at the tip of the needle, the moment the tip of the needle comes in contact with the spinal fluid, an alert is generated. The physician can then work in an efficient way and carry out operations in close proximity to sensitive nerves of the spine in contrast to the old haptic perception of working with the needles. (Halonen, 2016) It has been also stated in a report from Ernst and Young that consumers are able to sync the functionalities of their daily lives just by accessing their personal devices like locking the doors of their house automatically, resetting the thermostats when there is no one in the house and various other tasks that are required to be done manually but can now be accessed by their smart devices. Similarly, we also propose the idea of making basic functionalities that a normal hostel resident would perform manually and which can be done automatically by the use of the framework proposed. (EY, 2016)

With increasing, population demand for smart devices and services are increasing. There are many IoT based frameworks like smart home, smart buildings etc. are already in the development phase. In this paper, we are going to present a conceptual framework "Smart Hostel" which is created by keeping all the major problems of hostel and solution for these problems are also proposed.

III. CASE FOR SMART HOSTEL DEVELOPMENT

Future is going to be the era of connected and automated devices. The underlying technology which is going to be a driver for the development of connected and automated ecosystem is internet of things and Artificial intelligence. Today we are working on the smart home, smart buildings, smart contract, etc. and trying to develop an ecosystem of connected devices. In this paper, we are going to present a framework of the smart hostel. The motivation for creating this prototype is the development of internet of things industry and a large number of residential university and college campuses across the world. There are a lot of facilities provided by various hostels but are not utilized to their full potential due to lack of information to the user. Also, there are some of the services

which are required by residents but they are not provided because the problem doesn't reach to the authority. The main objective of this framework is to provide information to the right person at the right time across the college campus.

If the information is delivered to the right person at the right time, then the probability of getting that problem solved increases to a great extent. Suppose a resident is roaming somewhere in the city and want to catch college bus. But due to lack of information about the current location of the bus he/she is not able to catch the bus. In that case, he/she has to book a vehicle to reach to the campus. This results in monetary loss of that person. Also, it has an adverse impact on the environment as more fuel is required to be exhausted. All these problems arise due to lack of information.

Another major problem for hostel residents is the availability of water. Though it is mentioned on the notice board of hostels about the timing of availability of water, real time monitoring of water is required. If water level, temperature and pH is monitored in real time then it will have huge positive impact on the health of residents. A large number of people are not able to utilize water optimally due to lack of information. So here also information plays an important role.

Similarly, there is a huge number of cases where services provided are not delivered to the right person at right time due to lack of information. Also, the authority is unaware about the problems faced by hostel residents due to lack of information.

Apart from these, there will be a lot of information which will be generated by devices when they are connected to each other. Hostel residents are one of the major costumers of e-commerce companies. As we will get a tremendous amount of data from this ecosystem, it can be monetized and the better product can be delivered to hostel residents. Big data analytics can be applied to the purchasing pattern and consumer behavior can be utilized to enhance business. Suppose through this ecosystem we come to know that in a room there is a requirement of induction cooktop by precisely monitoring electricity consumed. Then he/she can be shown advertisement of induction cooktop and also provided some discount. So, such kind of individual marketing is possible in this ecosystem. In our paper we have talked about making use to various sensors to ease the problems occurring in hostels such as electricity not being turned off on time, water not being available to students at times, retail shops near college being closed thereby causing inconvenience to students, medical services not up to the mark for students.

A similar if not exact applications of sensors had been highlighted in a report from EY as well which states the use of sensors in various fields such as environment, water, metering, security and emergency services, retail, logistics, industrial control, agriculture, farming, domestic and home automation, and e-health.

As we talk about exploring the problems faced by students in the hostels, in a report from KPMG, they have talked about various problems faced by enterprises which can be solved by using the deployment of IoT devices in the enterprises. The KPMG`s report talks about boosting the connectivity within an enterprise while we talk about increasing the convenience within a hostel for students. (KPMG, 2017)

Hence, we can provide comfort to residents vis-à-vis we can also enhance our business.

IV. PROPOSED FRAMEWORK FOR SMART HOSTEL

In this framework, we are proposing to deploy a screen in each room where all the valuable information will be displayed. This will be a smart device where users will not only get information but also be able to request for required services. There will be a database for all the services which will be cloud based and will be connected to all the devices across the campus. Also, there will an app for smartphone using which students can interact with the database to get the information they need.

Smart service	Problem	Solution
Smart Cleaning	Room Cleaning	Sensor based reporting for room cleaning.
Smart power control	Appliances turned on without use.	Sensor based auto control of appliances in room.
Smart routine display	Students are unaware of daily routine.	Display class timetable at right time on screen.
Smart smoke sensor	No safety device present in room.	Deploy smoke sensor in each room.
Smart water system	Temperature, pH and availability of water is difficult to know.	Deploy sensor in water tank to detect water level, temperature and pH value.
Smart Medical system	Medical facilities are not provided	Provide an app to each student so

	on time.	that medical services are provided on time.
Current Affairs	Students are generally unaware of current affairs.	Display device in each room will have current affairs as default screen.
Smart Laundry	Students find difficulty in getting status of clothes at laundry.	Maintain a database at laundry.
Smart bus locator	Students find difficulty in getting location of bus.	Install college bus with GPS device.
Smart classroom	In case student is not in position to attend lecture.	Live streaming of classroom at student device.
Smart crowd monitoring	Students find difficulty in getting crowd status at mess, parking and canteen.	A database at mess, parking and canteen premises will be deployed.
Smart library and Laboratory	Students generally don't know whether the book/equipment they require is available or not.	A database of book/equipment will be maintained in library.
Smart Environment	Students generally ignore environmental condition which affect their health.	Pollution and other environmental factors will be monitored and conveyed to students.

Following are the problems related to the hostel which can be solved by this framework:

1) *Problem1:* Hostel rooms are generally not cleaned properly.
2) *Proposed solution:* In this framework, we are proposing a deployment of an optical sensor which can detect dust particles in parts per million and when the particles per million increases above the threshold level then it will be informed to the hostel service room as well as resident. After this proper action can be taken by resident and authority. Apart from this if an automatic vacuum cleaner is deployed then it can automatically have switched on and the room will be cleaned.
3) *Problem2:* Electrical appliances are switched on in many cases even not required.
4) *Proposed solution:* In this framework, we are proposing a deployment of an infrared sensor which can detect the presence of the person in the room. If the person is not available in the room, then appliances will be switched off automatically. Also, we can deploy a sensor at the entrance which can detect the entry and exit of a person based on which we can predict whether a person is present in the room or not. We will also deploy a temperature sensor which will detect the room temperature and appliances like fan, cooler, AC etc. will be adjusted based on user requirement.
5) *Problem3:* Students are unaware of daily routine and they ask each other about it and they have to search it through multiple sources which are quite a complex job.
6) *Proposed solution:* The screen deployed in each room will be connected to college server which will display the daily routine at the desired time.
7) *Problem4:* There is a requirement of the smoke sensor to be deployed in each room.
8) *Proposed solution:* The Smoke sensor is required to be deployed in each room for safety purposes. But it needs to be manually controlled as in case the user is using mosquito coil in the room then, in that case, the smoke sensor should be shut down. But for safety purpose, it should be mandatory to switch on the smoke sensor in the night.
9) *Problem5:* Shortage of water is one of the major problems for hostel residents.
10) *Proposed solution:* In this framework, we are proposing to deploy a sensor in the water tank (both drinking and non-drinking) which can not only detect the water level but also can detect the temperature and pH level of water.

11) *Problem6:* Delay in availing medical facilities.
12) *Proposed solution:* In this framework, we are proposing to have an emergency number which can connect to health center available on campus as well as to nearby hospitals. There must be at least 3-4 alternatives available so that medical facilities can be availed as soon as possible.
13) *Problem7:* Students are unaware of current affairs.
14) *Proposed solution:* In this framework, the screen which we are deploying will have news flash as default. So, in case, nothing is coming on screen then news item will be displayed on it.
15) *Problem8:* Student normally doesn't wash their cloth by own and give it to the laundry for cleaning. But to know the status of their cloth they either call or visit the shop.
16) *Proposed solution:* In this framework, students will be able to see the status of their cloth on the screen deployed in their room in an easy way.
17) *Problem9:* Students are not able to locate their college bus when they are in the city and they have to find an alternative which leads to higher cost of transportation.
18) *Proposed solution:* In this framework, every college bus will be equipped with a GPS device and hence can be located by students so that they can reach the bus stop at the correct time.
19) *Problem10:* In hostel courier is delivered in either college or hostel office instead of the particular room. So, monitoring the courier is also a difficult task.
20) *Proposed solution:* In this framework information about courier will be updated in a database and will be shared with the user so that he/she will be aware of courier delivery.
21) *Problem11:* In case the student is not well and not able to attend the class. This leads to the loss of the student.
22) *Proposed solution:* In such cases, the screen deployed in the room can be used to watch the live stream of class and attendance of students can be marked as present if he/she has attended the class. But there is the requirement of strict policy to facilitate such kind of services because if not taken care of then it can lead to bunking of class.
23) *Problem12:* In case some pungent smell is coming to or from the room.
24) *Proposed solution:* In such cases, it will be informed to hostel administration and action will be taken as soon as possible.
25) *Problem13:* Availability of food in Mess is also a major problem for students.
26) *Proposed solution:* Rooms and dining area are distant apart in most of the cases and students are unaware of the availability of foods in mess. Also, mess menu is a concern for students. In this framework, we will provide information about mess menu as well as the availability of food in the mess so that students can reach mess at the right time and have food.
27) *Problem14:* Crowd at college canteen is also a concern for students.
28) *Proposed solution:* In this framework, we can provide information about a number of orders served in last 1 hour and number of pending orders based on which we can analyze crowd at college canteen.
29) *Problem15:* Local shop either inside or outside campus is open or closed.
30) *Proposed solution:* We can deploy a sensor at the nearby shop through which we will be able to know that whether the shop is open or closed. Also, we can create the database of the particular item so that students can know in which shop they will get item required by them.
31) *Problem16:* Local area traffic status
32) *Proposed solution***:** This can be simply done by integrating google or any other maps to the framework.
33) *Problem17:* Some students are not aware of ongoing and upcoming events on campus. It happens mainly when there is more than 1 college in the same campus.
34) *Proposed solution:* Information about all the events will be entered into a common database and will be shared with all the residents of that campus.
35) *Problem18:* College parking status is also one of the major concern for students and faculties.
36) *Proposed solution:* A sensor will be deployed at the entrance which will count the number of vehicles present in the parking area. Also, it can detect the type of vehicle present in the parking area. Based on this information it can be analyzed whether parking space is available or not. Also, we can deploy a sensor which will alert the people in case they have not parked their vehicle in the correct way.
37) *Problem19:* Availability of book in college library required by students is also a concern.
38) *Proposed solution:* To solve this problem we can link library database to this framework so that students can get the book and other material without much effort.

39) *Problem20:* Some anti-social elements are also present in the hostel who creates unnecessary noise which disturbs others.
40) *Proposed solution***:** In this framework, we will deploy a sound sensor which will alert hostel administration in case any unnecessary sound is generated so that they can take appropriate action. High sound becomes a major problem in case someone is sick
41) *Problem21:* Internet health.
42) *Proposed solution:* As this framework is fully dependent on internet so the internet must be present in any case. So proper monitoring of internet health must be done and regular maintenance must be done on internet devices.
43) *Problem22:* Daily use item monitoring
44) *Proposed solution:* If the user updates about daily use product in the database and average daily consumption then this framework will inform him/her about refilling of product.
45) *Problem23:* Insects and flu monitoring
46) *Proposed solution:* In case some dangerous insect or flu is observed by anyone in campus then using this framework it can be easily communicated to everyone and campus administration can take appropriate action at the right time.
47) *Problem24:* Calamity monitoring
48) *Proposed solution***:** In case of any calamity observed either in campus or nearby area and someone is unaware of it then this framework will inform each individual inside campus easily.
49) *Problem25:* Laboratory status monitoring: This is a problem mainly for engineering and medical students who have to experiment for some project and lab is not available.
50) *Proposed solution:* In this framework, a database of all the equipment available will be updated in the database and students will be able to find that whether the equipment required by them is available or not. If not available, then they can issue a request from the same platform. Also, student can know about the crowd in the laboratory in this framework.
51) *Problem26:* General office status monitoring: Students are unaware whether faculties or non-teaching staff is available on campus or not.
52) *Proposed solution:* In case some student wants to meet some faculty or other staff, it must be known that whether that person is present on campus or not. So, to know the presence of faculty in campus, general office database will be linked to this framework.
53) *Problem27:* Campus amenities availability monitoring
54) *Proposed solution***:** A database of all the amenities will be made. All the people using these facilities will be monitored in real time and based on this crowd will be analyzed. And this database will be linked to the framework.
55) *Problem28***:** Campus pollution monitoring
56) *Proposed solution:* Pollution level of campus will be monitored and will be entered into the database so that students and campus administration can take appropriate action for their safety.
57) *Problem29:* To check whether the student is present on campus or not.
58) *Proposed solution:* The biometric will be linked to this framework and hence the presence of an individual on campus can be checked by campus administration.

V. MARKET OPPORTUNITIES & MAJOR CHALLENGES

A. Market Opportunities

A report titled “The Internet of Things Business Index: A quiet revolution gathers space”, also found that 30 % of business leaders feel that the IoT will unlock new revenue opportunities, while 29 % believe it will inspire new working practices, and 23 % believe it will eventually change the model of how they operate. The study found that European businesses are ahead of their global counterparts in the research and planning phases of implementing IoT. Meanwhile, manufacturing is the leading sector when it comes to research and implementation of IoT technologies, driven in part by the need for real-time information to optimize productivity. According to the report, the top five concerns that companies have around the IoT are: a lack of employee skills/knowledge; a lack of senior management knowledge and commitment; products or services that don’t have an obvious IoT element to them; immaturity of industry standards around IoT; and high costs of required investment in IoT infrastructure. The 779 respondents came from 71 countries across Europe (29 %), North America (29 %), Asia-Pacific (30 %) and rest of the world (12 %). However, a few steps need to be taken if the IoT revolution is to really take off. The report suggests that data silos need to be removed and common standards need to be established in order to allow the IoT to scale to a size that will allow it to operate across all markets successfully. (Mukhopadhyay, 2014) The maximum capacity of the IoT will be opened when little systems of associated

things, from autos to worker IDs, wind up noticeably one major system of associated things reaching out crosswise over ventures and associations. Since a large number of the plans of action to rise up out of the IoT will include the offer of information, a critical component of this will be the free stream of data over the organize. Another interesting fact is that the internet connectable consumer household devices will increase significantly in the next decade, with the computer network equipment that accounts for the majority of household devices, at about 75% in 2010 and declining to 25% by 2020. (Mukhopadhyay, 2014)

The development of IoT and shrewd machines was bolstered by forecasts that enormous quantities of gadgets and robots would soon enter standard markets. What's more, this year, the increasing speed proceeds, however, it hints at solid prompting some optional impacts that may not be too foreseen. (Gartner, 2016)

By 2022, IoT-enabled service models could save a trillion dollars a year in maintenance and service costs. This prediction aligns with the idea that, with such a large number of devices ($2.5 million per minute in IoT spending and 1 million new IoT devices sold every hour by 2021), we can only expect that those devices and connections will create new ways to make money. (Gartner, 2016)

The Internet of Things has the colossal potential for information era over the approximately 21 billion endpoints anticipated that would be being used in 2020. Covered up inside this tremendous sea of information lies esteem; notwithstanding, to open its potential, this information must be ingested, secured, put away and examined. Information stockpiling includes some major disadvantages as server farm equipment and programming framework are essential to building up an effective IoT design predicated on dealing with the ingestion, security, stockpiling and examination of gadget information. For associations to prevail at this (in this way flagging more prominent stockpiling interest for sellers in the inventory network), an unmistakable pathway of ROI must be accomplished. To legitimize their framework speculations, associations need to see unmistakable business esteem from client confronting income producing openings, and in addition expanded dexterity and enhanced operational efficiencies. Note that the crude information stockpiling considers don't bring with thought information diminishment innovations, which would possibly lessen the capacity impression, nor do they factor in reinforcement and recuperation or replication for higher accessibility, which would conceivably build the capacity impression. (Gartner, 2016)

With billions of individuals associated with the web today, and the quantity of associated gadgets to surpass 50 billion by the year 2020, the Internet of Things (IoT) speaks to a noteworthy change in an advanced world that can possibly influence everybody and each business. (EY, 2015)

IoT will offer open doors for organizations which are producing IoT merchandise, and furthermore for those organizations which are giving administrations identified with IoT. The makers of shrewd gadgets, sensors or actuators, and the application engineers, promoting strategists, systematic organizations and network access suppliers (ISPs) will all benefit from the advancement of IoT. As indicated by industry gauges, machine-to-machine (M2M) correspondences alone will create roughly US$900 billion in incomes by 2020. (EY, 2015)

Cell phones keep on being the biggest classification of associated gadgets yet in 2018 they are relied upon to be outperformed by IoT, which incorporates associated autos, machines, utility meters, remote metering and purchase hardware. IoT gadgets are required to increment at an exacerbated yearly development rate (CAGR) of 23 percent from 2015 to 2021, driven by new utilize cases. Altogether, around 28 billion associated gadgets are estimated by 2021, of which near 16 billion will be identified with IoT. (Ericsson, 2016)

While there are changing evaluations and conjectures for the quantity of brilliant associated gadgets, our examination demonstrates that we anticipate that there will be anyplace between 30 to 50 billion associated gadgets by 2020. These 50B associated gadgets, as per industry examiners at IDC, will drive the aggregate IoT market to US$8.9 trillion by 2020, with three portions – customer hardware, car and human services – representing over half of the aggregate market in income terms. The breakdown of the anticipated US$8.9 trillion IoT showcase by 2020 shows shopper hardware at US$2.2 trillion to be the biggest fragment by measure, trailed via car (US$1.8 trillion) and human services (US$1.3 trillion). Different parts like vitality, industrials, and development that haven't generally received a large number of the most recent electronic frameworks and innovations are relied upon to develop at quicker rates because of the improvement of the IoT. (PWC, 2015)

As IoT develops, so do the volumes of information it produces. By a few assessments, associated gadgets will produce 507.5 zettabytes (ZB) of information every year (42.3 ZB for each month) by 2019, up from 134.5 ZB for every year (11.2 ZB for every month) in 2014. (A zettabyte is 1 trillion gigabytes). Internationally, the information made by IoT gadgets in 2019 will be 269 times more prominent than the information being transmitted to server farms from end-client gadgets and 49 times higher than add up to server farm movement. (Deloitte, 2015)

An expected 20.4 billion associated things will be being used worldwide by 2020. The quantity of IoT gadgets utilized by ventures will dramatically multiply to 7.5 billion. 66% of endeavors are relied upon to encounter IoT security breaks by 2018. By 2020, more than 25 percent of distinguished endeavor assaults could be IoT-related — however IoT security represents just 10 percent of IT security spending plans. Among 3,100 organizations reviewed all inclusive, simply finished half have actualized IoT — and 84 percent have officially encountered a security break subsequently. Digital assaults on organizations internationally cost between US$4 million and US$7 million by and large a year ago. Among more than 5,000 endeavors overviewed around the globe, 85 percent are, or will be, sending IoT gadgets — yet only 10 percent feel sure about securing those gadgets against programmers. (KPMG, 2017)

B. Major Challenges

1) *Integration of heterogeneous IoT-based networks:* Usually IoT-based networks need to link ecosystems of technologically heterogeneous devices. This diversity makes difficult the integration of things into the Web. Some IoT platforms as Cosm or Paraimpu have designed their own strategies to integrate data streams from open source devices as Arduino. Other platforms, as Sensinode or SmartThings, have created their own hardware products which are compatible with their respective IoT platforms. The most appropriate solutions would be those offering high-level mechanisms to integrate additional types of embedded devices, based on both proprietary and open source hardware. The objective is to create a larger scene attracting developers specialized in most popular sensor and actuator embedded technologies (e.g. Crossbow, Zephyr, Sun SPOT, Arduino, etc.). To this aim, it is necessary to simplify the mechanism to integrate things as much as possible by hiding to developers the technical aspects of the platform. (Mukhopadhyay, 2014)
2) *Adaptive scalability:* Typically, IoT platforms are provided through cloud services with high capabilities to manage milliards, even thousands, of things per user. This kind of services can scale a lot and they are only limited to the available resources of the servers supporting them. Apart from this, IoT platforms for homes and small businesses are being more and more popular since they allow users to take full control over security issues. Thus, this is an important property for services managing sensitive information, e.g. those based on eHealth or home security. The latter type of platforms is deployed to work at smaller scale using hubs (also called Smart Gateways) through which any necessary device can be connected to a smart space. However, these Smart Gateways are limited in hardware resources, so their scalability is also limited. Thus, it is needed to explore a trade-off for small and medium scale deployments (e.g. in factors as a number of deployed sensors/actuators or rate of generated events) in order to optimize the performance of these Smart Gateways. (Mukhopadhyay, 2014)
3) *Data filtering and alert notification:* When managing a plethora of things generating big amounts of data it is necessary to implement mechanisms to filter raw data in order to optimize the processes that will store and dispatch information to the clients. Simple filtering mechanisms are typically defined by means of first order rule engines or data source combination (e.g. aggregation or fusion of data sources) by applying functions to aggregate them. Data filtering techniques are very often related to the detection of events. Other approaches take advantage of Semantic Web techniques in order to disseminate data by performing complex inferences. Ideally, the design of open platforms should include an event-driven subsystem based on the publisher/subscriber communication paradigm. For example, Cosm provides an unsophisticated filtering mechanism based on simple rules in order to detect events and send notifications to a Twitter account. This functionality should be implemented through generic event-driven mechanisms in order to dispatch notifications to any subscribed application or service. (Mukhopadhyay, 2014)
4) *Sharing of knowledge resources:* Sharing knowledge resources is the cornerstone of collaborative networks with different objectives, e.g. scientific, technological or social. Consequently, this aspect has to be taken into account when designing IoT open platforms. These platforms should provide mechanisms to share resources in collaborative networks or just to distribute such resources among users that may be interested in them. A very accepted proposal to offer resources sharing is the called API key. These API keys allow accessing specific resources (e.g. sensor streams, actuator control or monitoring tools) only for trusted users. Additionally, those resources can be available both permanently and for a period of time. Arecent proposal tries to take advantage of social networks (e.g. Twitter, Facebook, LinkedIn, etc.) and their open Web APIs in order to share smart things among trusted users. This proposal is based on an authentication proxy, called Social Access Controller (SAC), which allows publishing and sharing smart things among user groups registered in some social network with specific credentials. (Mukhopadhyay, 2014)
5) *Development and deployment of services:* The own nature of an open platform is to provide a public Application Programming Interface (API) that allows quick prototyping of complex applications by creating mashups consisting of a variety of both

sensor data sources and actuator control points. Ideally, open platforms have to provide natively common services for many applications (e.g. Data visualization or localization services). However, an enriched API should offer a set of development tools to application developers to create their own additional applications for processing and visualize data. New trends are focusing on mapping APIs for IoT services into RESTful services in order to take advantage of Web techniques. (Mukhopadhyay, 2014)

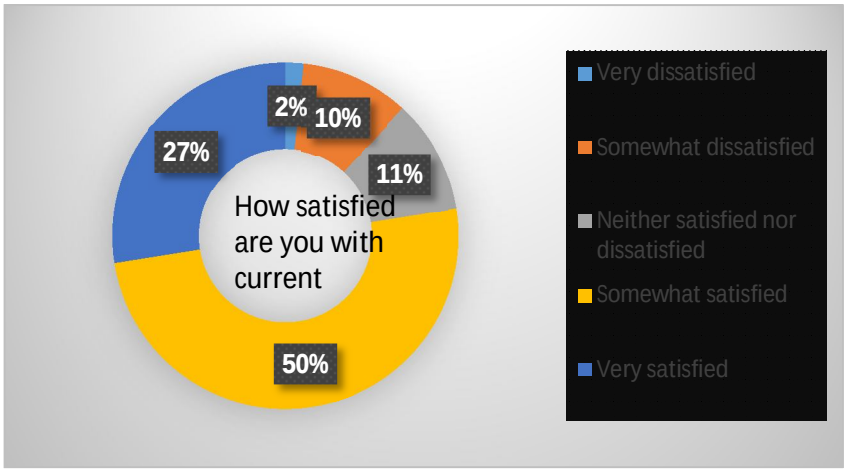
VI. RESEARCH METHODOLOGY

This study is based on the problems faced by hostel residents. A list of problems was prepared and based on that questionnaire was created. Most important problems were considered for the questionnaire and a survey was conducted on that questions. This study is based on both primary and secondary sources of data. In this study, we have tried to develop a prototype that can solve various issues of hostels and various solutions are proposed for the problems.

VII. ANALYSIS

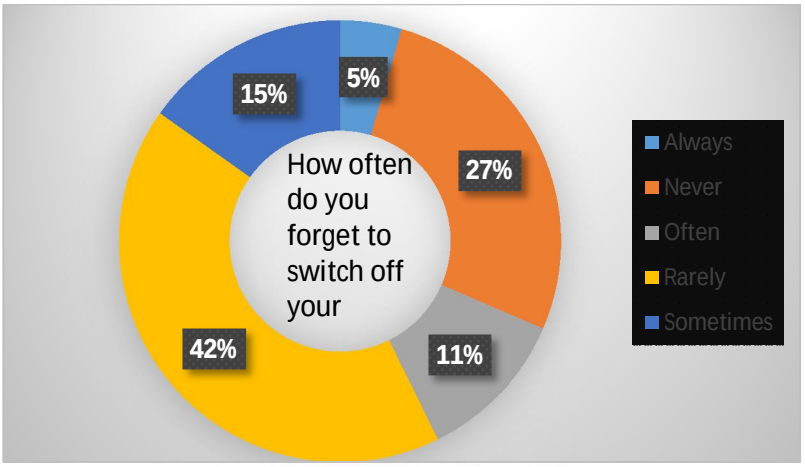
To understand the responses from the real population living in the hostels in different hostels across India and primarily symbiosis, a survey was conducted which included questions to take the input from the students regarding various issues being faced regularly in the hostels. The audience for this poll were all the students who have stayed in hostels at one point of their lives and also the ones who are currently staying. A total of approximately 200 responses were collected.

A. Room cleaning services



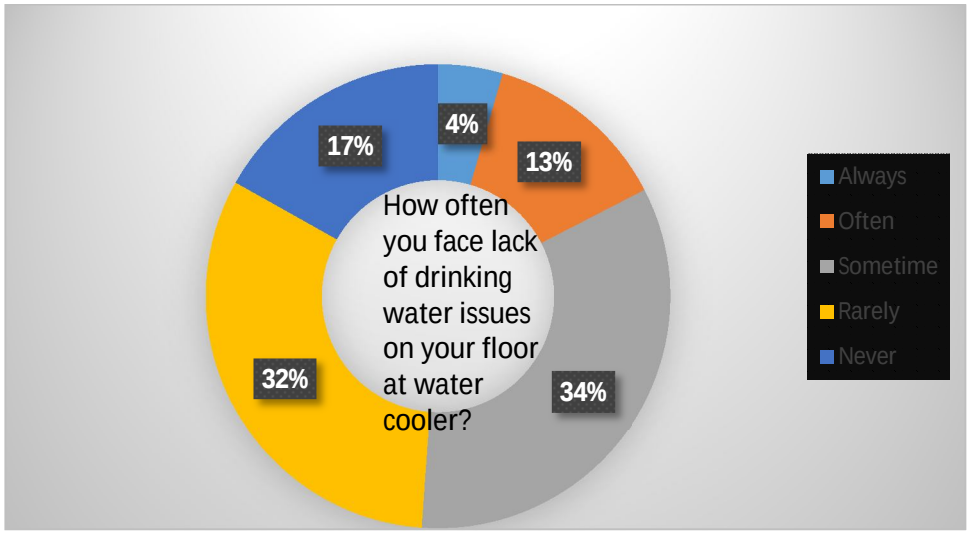
It was found that 50% of the of the people who stayed in hostels found their room cleaning services only somewhat satisfactory while 27% found it to be very satisfactory and 10% were in the category which considered the services in dissatisfactory category and neutral category, implying that majority of the students who have faced the hostel life have not really experienced very good room cleaning services

B. Switching off electrical appliances before leaving the rooms at hostels



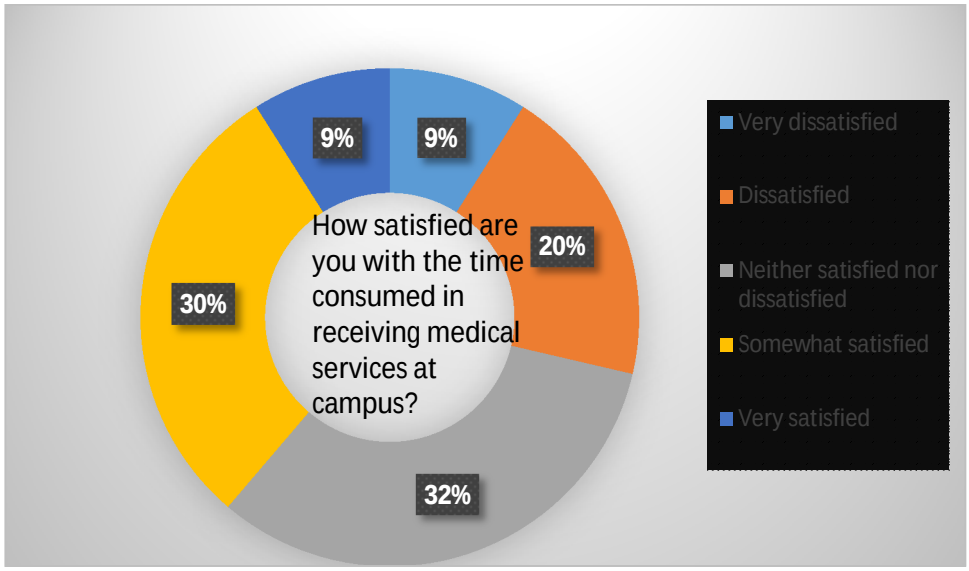
Majority of students almost 70% to be precise come in the category who never or rarely forget to switch of their electrical appliances when they leave their hostel rooms implying that students of the present generation have become considerably responsible enough to make effective use of resources like electricity. However, 30% of the population of students still sometimes or always forgets to switch off the electrical appliances such as fan lights etc. while leaving their rooms.

C. Drinking water issues



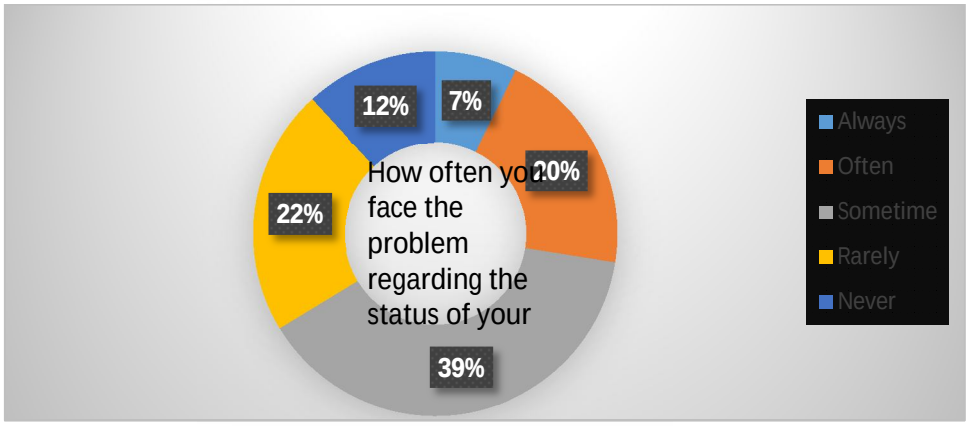
Almost 51% of the students said they either sometimes often or always have drinking water issues at their hostel rooms, while the rest 49% had rare water drinking issues. This shows that even today at this point in time in India when we feel that at least in educational institutes and their facilities the problem of water would not be existing, we still find approximately 50% of the students facing the issues of obtaining drinking water at any point of the time during a day. Thus, it can be analyzed that a superior solution would be needed to address this problem to bring this number down to minimum 10%.

D. Medical services



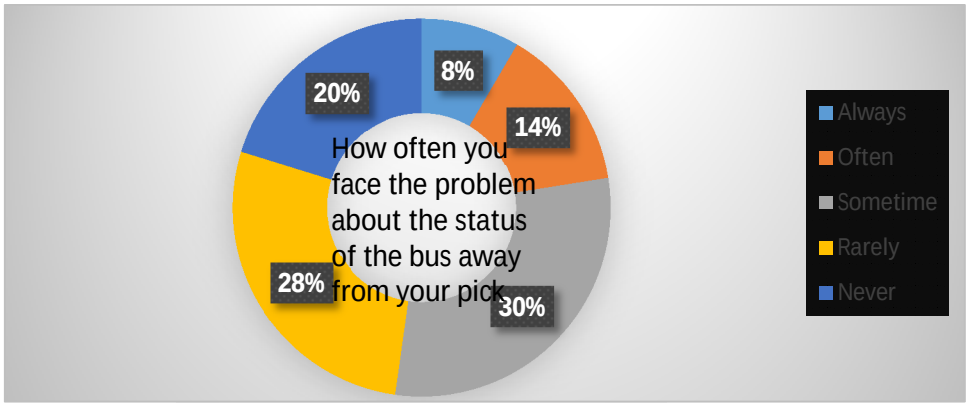
Every now and then accidents keep happening at colleges and hostels, students get hurt, fall off, fall sick, road accidents etc., are very common reasons for which medical facilities should be compulsorily deployed at every hostel. But from the survey conducted it was found that almost 62% of the students were unhappy with the medical facilities provided to them and 30% of the students too were only somewhat satisfied. This shows that there is an imperative need of improving medical services for the students at the campus and at hostels so that any fatal injury caused to any student can be taken care of immediately.

E. Laundry status



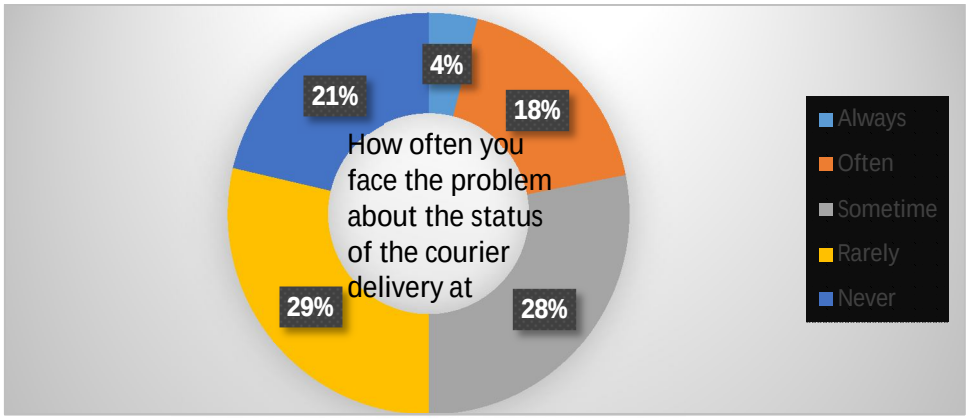
It was found that 50% of the students residing at hostel decently not happy with the status of the laundry being done at their campus laundry facility and 28% were also only sometimes satisfied with the laundry services while 23% students always faced the problem of laundry at their hostels. In order to improve the life of a student at hostels, it is essential that basic needs such as laundry should be given importance by the management.

F. College transports



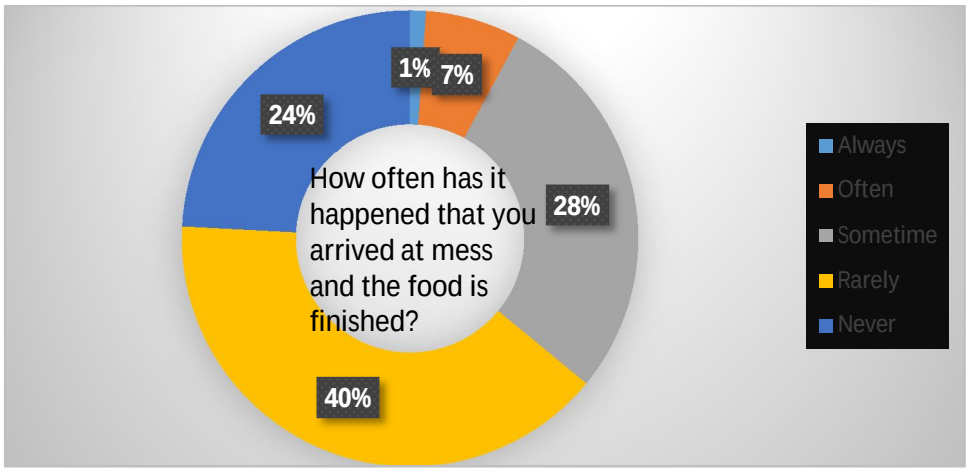
College buses are very important for a student especially for those students who go and study in the cities other than their home city. In the survey a question asked to the students was that how often did the face the problem of knowing the status of their bus from the pickup location, in return we found that approximately 48% of the students never or rarely had a problem with their bus services while 28% of students sometimes faced issues which the status of their bus locations and 8% of the students always had a trouble with their transport facilities at college.

G. Courier service



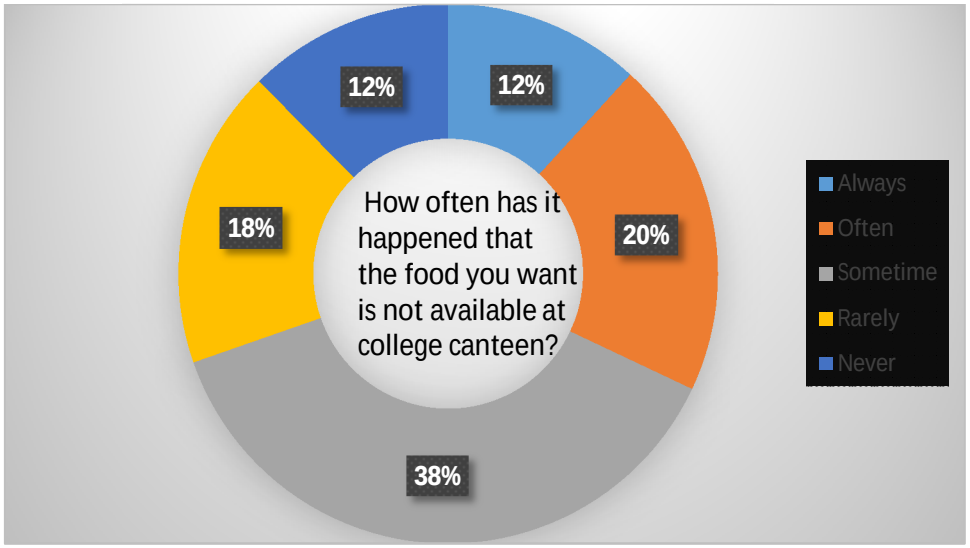
Sometimes it so happens that students require their important documents, specific items being called from their homes to the hostel and also with the strong emergence of e-commerce websites, many students now order their daily use items online, therefore it is essential that the receivable of couriers should be taken care of by either the college`s front office or the hostel`s front office. Keeping this in mind we had asked the questions to the students that how often did they face any problems in receiving their couriers and it was found that 50% of the students were adequately satisfied with the services being delivered to them. However, 22% of the students were unhappy with this service and it was also observed that 28% of the students were somewhat satisfied with the services courier being given to them at their hostels.

H. Mess Food issues



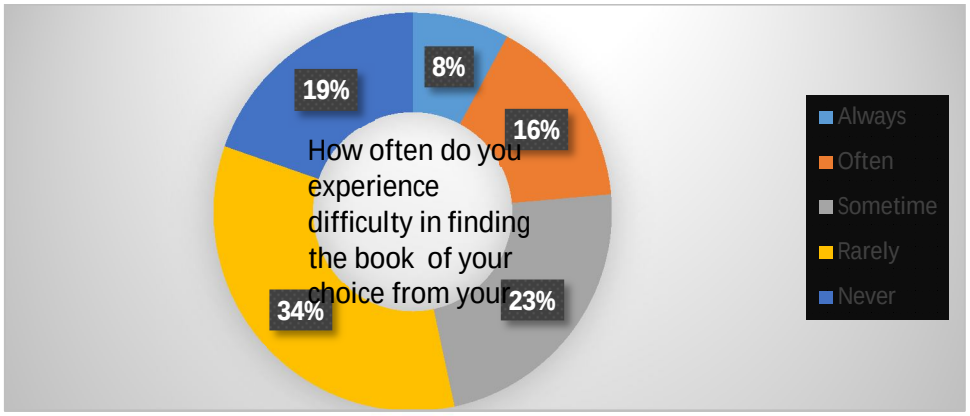
Almost 36% of the students said that many times they did not receive the food when they reached to their dining areas, while the rest of them were adequately satisfied with the services they received. The reasons for not receiving food on arrival could be that the students don't reach the given time window to the mess or sometimes the rush in the mess could be more resulting in the early finish of food at the mess facility.

I. College canteen



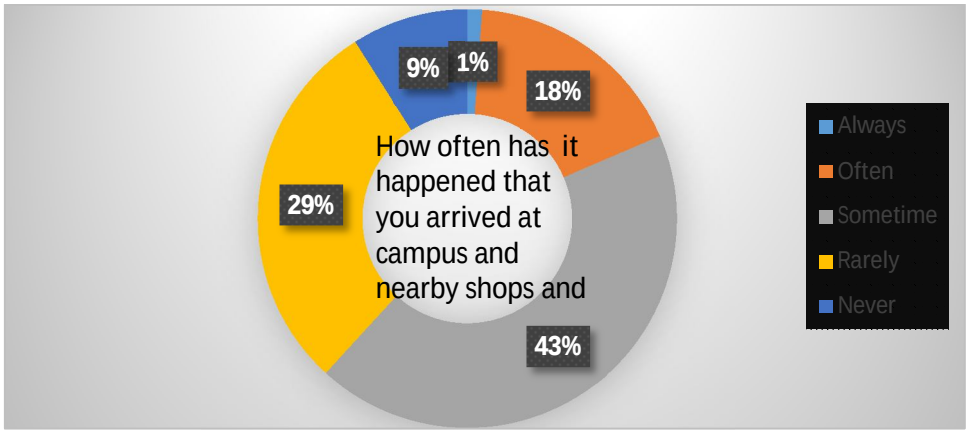
It was found from the survey that almost 70% of the students didn't receive the food of their choice at their college canteens whenever they wanted, either the food was not available on that day or it got finished due to limited stock. Only 30% of the students always got what they wanted from their canteens. This shows that in order to deliver good services to the students even college canteens need to take an effort.

J. Library issues



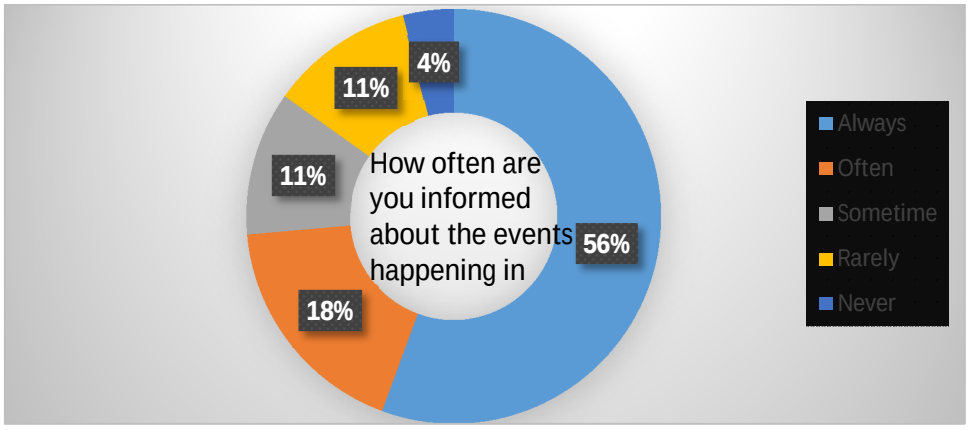
53% of students never faced any problems in finding a book in their college library while 23% of the students sometimes faced difficulty and almost 22% of the students always found difficulties in finding the book of their choice at their college libraries, thus to solve this problem a proper search system should be established which would help students easily find the book of their choices.

K. Campus and nearby Shop



All colleges whether residential or non-residential do have small shops near their hostels which contains the items of basic needs of the students. And also, it is essential for these shops to remain functional at all point of time during the day because the need of every student varies and so does the urgency level. From the survey, it was found that 39% of the students did not find such shops closed whenever they needed while 43% of the students sometimes did find it closed many times and 18% of the students found the shops closed almost all the times.

L. Events



When there is a huge campus for colleges, more than one Institute is located at such campuses and therefore each college comes up with various events throughout the year. But unfortunately, not every student in the campus is aware of such events and thus end up missing the chance to be a part of that event or volunteer or enjoy that event happening on the campus. It was found that almost 56% of the students always missed on the latest events happening in the college and 17% often missed it while only 15% of the students almost never missed on knowing the events happening at their campus. A proper awareness campaign regarding all the events happening in all the colleges on a campus should be informed to all the students.

VIII. CONCLUSION

In this paper, we introduced a prototype of the smart hostel which can solve a lot of problems faced by students residing in the hostel. 29 problems are discussed in this paper and we have proposed the solution for these problems. A survey was conducted to know whether these problems are faced in every hostel or not and we come to know that more or less these are the problem of each hostel. On the basis of our survey we conducted we have found that room are not properly cleaned at hostel and there is requirement of a method so that information about room cleaning must be reported to the concerned people so that room can be cleaned at the right time, along with that it was also observed that only one third of the people forgot to switch of their electrical appliances and almost half of the population living in hostel surveyed agreed that that there is drinking water availability issues at hostel. Around two-third of people are not happy with the medical facility provided at hostel in addition to that laundry facility is not able to satisfy more two-third of population. Although it is not a big issue from student's perspective as they hire other vehicles. But from environment perspective it is a big issue as more fuels are consumed only due to lack of information. Other than this it was also observed that half of the respondents is not happy with the current system of courier delivery as there is no proper channel that can inform them about the status of delivery of courier. In some case it is observed that courier is shown delivered on courier delivery service providers website but actually not delivered. Based on our observation around one-third of population face difficulty in getting food mess in time. It is because they are not informed about real time food availability status.

Availability of food of their choice at college canteen is great concern for students. Around 70% respondents in our survey agreed that they face such problems plus if we consider the library facilities, getting a book in library is not a big issue as per our survey because only one-fifth of respondents believes it to be an issue. It was also found that almost two third of the students found the shops of basic necessities closed in their campus thus depriving them of the items of necessity on urgent basis. Other issues were also there such as half of the students being not aware of the events happening in their college, thus getting deprived of the opportunity to participate in them From the above statements, it can be confidently concluded that, students are facing problems in areas of necessities and in areas of leisure, therefore we propose this framework which can cater to all these problems and issues and thus add to the convenience of each student or user in this network where this framework is deployed or implemented

IX. RECOMMENDATIONS

Problem	Recommendation
Room Cleaning not done properly.	Deploy sensor in each room and connect to this framework so that users are informed whether room is clean or not.
Electrical appliances are switched on even they are not in use.	Deploy sensor in each room which can sense the presence of person in room and accordingly act.
Water availability issues.	Deploy sensor in water tank and collect information about water level and feed it in this framework.
Time to get medical facility is more.	Connect everyone inside the campus through an app so that information about any incident which requires medical facility can be conveyed to the nearest hospital.
Users are not informed properly about the status of their clothes at laundry.	A database to be maintained at laundry and connected to this framework.
College Bus status is not informed.	A GPS device to be deployed in each bus and it is connected to this framework.
Courier delivery status is not informed.	A database about courier to be maintained at college and connected to this framework.
Information about availability of food at mess and college canteen is generally not available.	A database about food availability to be maintained at canteen & mess and connected to this framework.
Information about availability of book at library is generally not available.	A database about book availability to be maintained at library and connected to this framework.
Information about nearby shops whether they are open or closed is not available.	Deploy sensor at nearby shops that can inform about status of shop (whether closed or open) and this information is fed into this framework.
Information about college event is not known to all students.	A database about events to be maintained at college and connected to this framework.

Some more recommendations:

A. We understand that use of many sensors will be a complicated set up in order to deliver the service that we are proposing here, hence we recommend that in order to avoid such bulky deployments, integrating of 4-5 sensors in one body should be done in order to save space and reduce the bulkiness of the equipment to be deployed and the robustness of the system and also this will result in reduction of the price per deployment.

B. Deployment of a central server to collect the data from all the deployed devices and this will act as a big data source for the entire college campus, later for the purpose of general information being released in the public domain for the purpose of inquiry, this data can be monetized and revenue can be generated from it.

C. In a report from Accenture, it has been mentioned that wastewater services in the UK are using sensors and analytics and also real-time data to find out the failures at various junctions and thereby respond to the failures immediately such as leaks or extreme weather conditions. In our framework to we have proposed a similar solution but in place of wastewater management system, we instead intend to solve the issues faced at every equipment deployed in each room of the hostel. This equipment will be connected to the central server and thus with the unique ID assigned to each equipment, if any sort of error occurs anywhere in the entire network, it can be immediately detected and remedies can be provided instantly. (Accenture, 2015)

D. Naming all the devices in the network and assigning proper ID to each device so that if any security breach of any sort of damage happens at any device, the operators can quickly come to know the point where the default has occurred.

E. Taking feedback on the functioning of the deployed devices from the users and further improvising on the deployment of such devices.

F. Whether there is a requirement or not, every year one maintenance check for all the deployed devices should be conducted.

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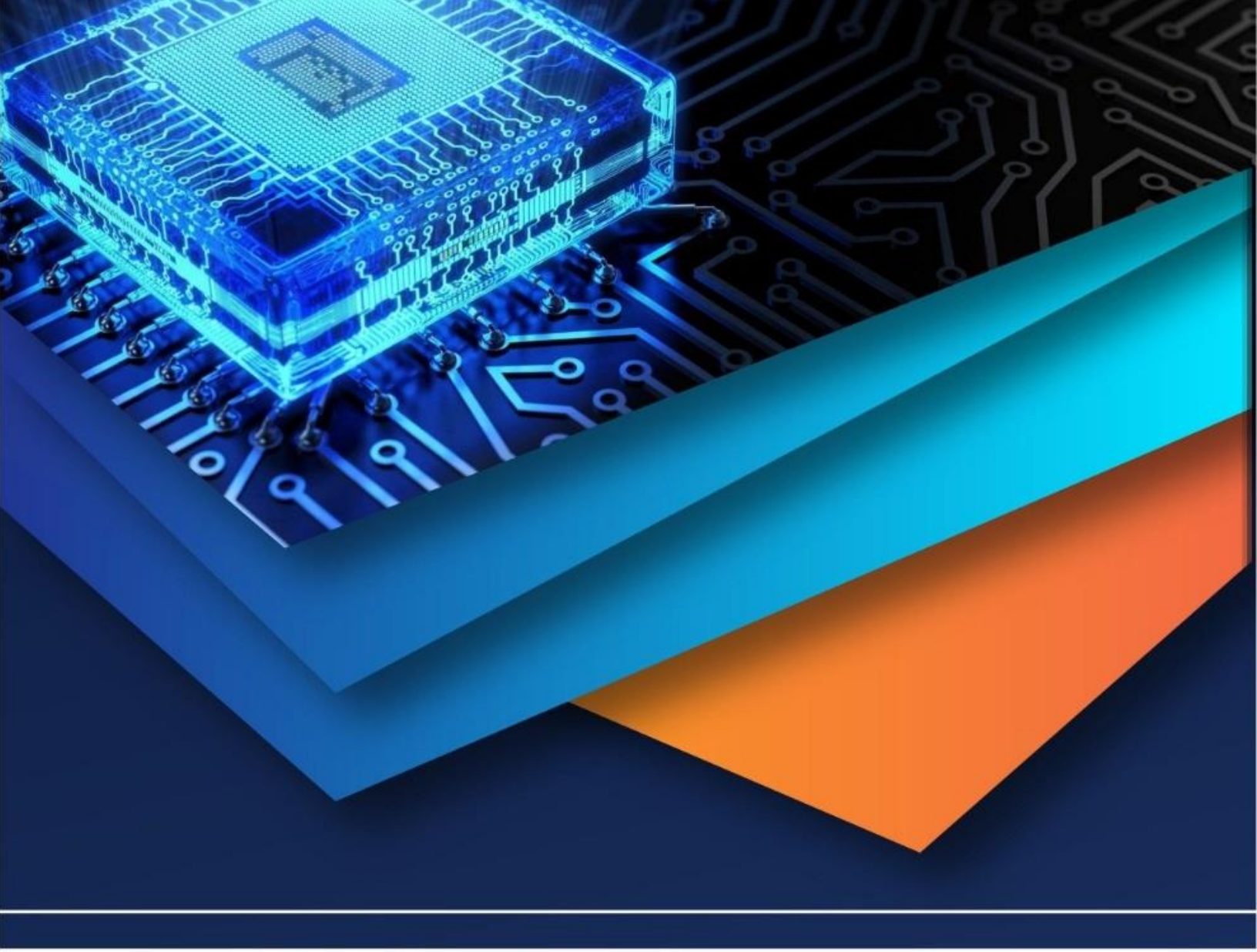

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