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A REVIEW OF SECURITY, PRIVACY AND INFORMATION LEAKAGE IN IOT BASED SMART CARPOOL SYSTEM

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Abstract:

Internet of Things (IoT) age has now started and it'll very much change our way of life. The most important purpose for IoT is formation of smart environments using self-aware things like smart transport, smart city, etc. for novel and innovative applications. Internet of things allows us to control objects that we use distantly through the internet. Negative effects of IoT technology are defenseless against to attack. So, there is increase in possibility of privacy information leakage which is causing economical damage to individuals thus also causing social and political damage. To address this problem, many risk measurement methods for information Leakage in IoT have been proposed in the past years.

This overview paper highlights possible application of the concept of IoT within smart city traffic surroundings that supported instance of carpooling system with utilization of a personal vehicle. It also discusses IoT security and privacy threats which cause information leakage. This paper presented and analyzed the IoT Security, Safety, and Privacy risks that provide a complete view of current issues due to the implementation of this technology.

Keywords: Security, Privacy, Internet of Things, Carpooling

Introduction:

Internet of Things is a continuation of web for coverage of real-world, allowing many modern services which will find a better everyday human life. IoT incorporates increasing familiarity of objects and entities (things) assigned with distinct identifiers as well as having ability for automatic data transfer in a network. Concept IoT has been used in a number of different

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technological areas, therefore its place is guaranteed in both transport and traffic application areas. A major problem in current day is that number of passenger vehicles/cars increasing rapidly thus being proportional to population growth, as a result this creating significant noise, traffic congestion and more travel timing. Carpooling is a transport model that allows ridesharing of a single vehicle to more than one passenger.

Smart carpooling comprises of pooling individual car space among people in similar routes. IoT concept involves a range of new possible smart carpooling methods corresponding to present scenario. While there are few software initiations to support carpooling practice, no one in reality uses that same features in finding people with same profiles and routes. Smart carpooling against cannot protect itself from security threats since internet is used here. This signifies that IoT devices can expose private data to attackers extractable from their weakness.

This research paper describes security threats like privacy information leak in IoT enabled smart carpooling. Paper is structured as; Section 2 describes backgrounds of carpooling system in brief. Section 3and 4 tells about IoT architecture and privacy and security aspects, Section 5 provides various Carpooling issues and finally Section 6 gives conclusion.

Background and Related Work:

We have a number of past works done that supports smart carpooling, but these works did not focus on standard car occupancy. Smart carpooling research has been one of the major inspiring as well as advanced research field. There are many findings in suggesting many alternates to this problem.

Agatz, Erera, Savelsbergh, and Wang given a detailed review of carpooling system [1].

Shaheen et al. recognized six important factors for casual carpooling success: a HOV requirement of three or more occupants; pickup locations near freeways, residences, parking, or public transit stops; a time savings incentive for drivers; a common drop-off location; reliable public transit for the return trip; and monetary savings for passengers [2].

Kelley introduced a term “enhanced casual carpooling”, which refers to addition of new technologies to casual carpooling. Although presently there are many organized carpooling projects, but yet no full-scale formalized system exists [3].

Bruck et al. attempted to find out solution of a daily carpooling problem aiming at CO2 emissions reduction with creation of a web application prototype by applying two heuristic algorithms and two mathematical formulations [4].

Reviewing past studies establish a lack of research on IoT concept application for functioning of carpooling system. This shows a motive along with a reason for authors to research the issue of using IoT concept for carpooling system purposes.

IOT Layered Architecture:

Not a single common architecture exists for IoT in carpooling environments. Because of challenging issues in IoT related to privacy and security, the five layers architecture has been proposed which is shown in Fig. 1. This one is considered to fulfill requirements of IoT from security and privacy aspects. These five numbers of layers can be discussed briefly as follows [5]:

1. Sensor Layer: It identify objects and gathers information related to objects. Different kinds of sensors such as 2-D barcode, RFID are linked to objects for their recognition. Collected information via these sensors varies in terms of motion, vibration, location, atmosphere and environment. These sensors are also useful as a tool for unauthorized monitoring privacy by attackers.
2. Transmission Layer: It links sensor and application layer. It is responsible for carries and data transfer from sensor layer to other connected devices via communication channel. Both wired or wireless transmission medium can be used i.e. cellular network, Wi-Fi, Zigbee, Bluetooth, etc. IoT device's connectivity is vulnerable to transfer malware as well as network attacks like DoS.
3. Processing Layer: Information transmitted from Transmission layer are collected and processed here. It is responsible for removal of additional meaningless information along with extraction of vital information. Whenever huge volume of information is received this layer affects IoT performance.
4. Application Layer: It utilizes IoT technology or defines and controls all applications that implements IoT such as smart carpooling, smart city, and smart phones. Since services provided rely on collected information by sensors that varies for each application. In specific, whenever smart carpooling uses IoT, several internal and external threats along withvulnerabilities occur.

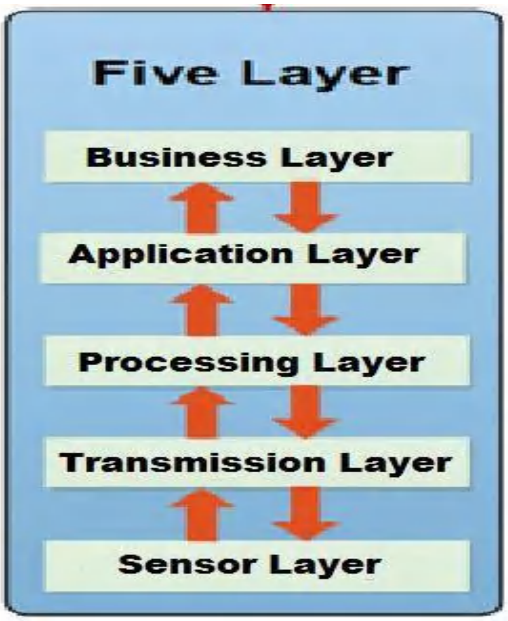

Fig. 1. IoT Layered Architectures

5. Business Layer: This layer reflects the desired behavior of application. It manages and controls business, application and revenue IoT model, also user's personal information is managed here. Application can be misused by attackers due to this layer's vulnerability.

Important Properties of Privacy and Security:

For assured use of smart carpooling applications, protection of privacy of user's identity along with location is most vital. In order to address this question in right way, smart carpooling must be supported with various privacy and security properties for assets prior to identification. Key properties of security are Non-repudiation, Authentication and Confidentiality and these have specific significance in privacy domain. Achieving confidentiality along with location and identity authentication must prevent malicious opponents from tracing as well as monitoring carpooling user's activity, so enhancing system trust level.

In addition, in a dynamic carpooling situation satisfying non-repudiation must help third party, like police officials, to show users' involvement in dynamic carpooling sessions. Considering actual privacy viewpoint, unlink ability is also an intended property along with other properties. It prevents attackers in rebuilding derived assets using basic information [6].

Table 1. Privacy and Security Properties

Property	Description
Authenticated positioning (AP)	Verifying location of users
Confidential positioning (CP)	Only authorized users aware of users location
Authenticated identity (AI)	Verifying identity of users
Confidential identity (CI)	Only authorized users aware of user's identity.
Non-repudiation (NR)	Non-ignorance by users for participating in carpooling activity.

Passenger Safety in Carpooling:

- GPS tracking where individual's journey in real-time can be shared with friends and family. Additionally, a list of behavior is maintained too so that regulatory actions can be taken against rider or driver.
- Cam services in public transportation are being introduced by many countries for increasing passengers and driver security. It also monitors suspicious behavior along with monitor passenger and driver behavior round the clock.
- Whenever harassment or rider's safety issues are concerned, ride-sharing application must contains a distress alarm. It sends a signal to ride-sharing service, along with passenger and driver information; that same signal can be sent to local legislature for any legal action to be taken if needed.
- On ride option there can be another option 'passenger insurance', which can be chosen by passengers to have a insurance coverage ride for their journey with an additional payment to avail this. If any issue arises, rider will be rescued by someone from them or third party as ensured by ride-sharing company [7].

Conclusion and Future Work:

Due to increase in on-road car numbers traffic jamming along with associated pressure in car parking resulting, and it need studying innovative measures for reducing number of cars traveling daily in major city areas, specific to single occupant vehicles. Carpooling involves sharing one's personal vehicle with single or more than one passenger where not only related passengers shares related costs but also co-operate in reducing traffic as well as pollution. In this paper, possibility of cars to motivate new kinds of social interactions is explored. IoT enabled carpooling is a new social-aware service that offer passengers and drivers an easier possibility to share a car. Here primary focuses was on security services that allows both mutual authentication of application components and users within a system.

This paper provides future research opportunities to work in this area. We believe that this study is important and gives an important contribution to researchers for IoT security development by additionally following different possible security issues like threats, vulnerabilities, thus will provide practical solutions to overcome IoT security threats.

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