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INTERNET OF THINGS IN INTELLIGENT TRANSPORT SYSTEM [ITS]

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ABSTRACT— Internet of Things (IoT) refers to uniquely identifiable objects and their representation in an Internet-like structure. The term, IoT although coined way back in 1999, became popular after the onset of RFIDs. There are estimates of more than 30 billion devices being wirelessly connected to the Internet of Things by 2020 .Our research is to structure a technical architecture with a suite of software where Internet of Things can be used to predict arrival timings of buses as well as manage the crowd inside each bus, dealing with an embedded system, which is used to intimate the passengers about the presence or absence of a bus in that particular route, at that particular time and manual ticket system are replaced by a cost effective automation system. A large scale model extensible through ubiquitous mobile communications is the main concept behind this proposed system.

Keywords— Internet of things, Transportation

INTRODUCTION

Nowadays automation can been seen everywhere .These automations and intimation systems are being designed and implemented for the welfare of the humans .This paper about the bus intimation system is not an exception to that trend. It has been designed by considering the same idea as our main and foremost priority. The project idea which has been discussed in this paper helps bus passengers to save time. Public bus transport system has been the most important and common modes of transportation used in India. However passengers have been wasting their precious time by waiting at the bus stop. Providing a real time update of the estimated time of the arrival of the incoming buses would help the passengers to save time. Also a cost effective system would be helpful for the government to implement it on large scale. These things are expected to be achieved using this project

A. INTERNET OF THINGS

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IoT on the Internet and economy are impressive, with some anticipating as many as 100 billion connected IoT devices and a global economic impact of more than $11 trillion by 2025.

Technical challenges remain and new policy, legal and development challenges are emerging. This overview document is designed to help the Internet Society community navigate the dialogue surrounding the Internet of Things in light of the competing predictions about its promises and perils. The Internet of Things engages a broad set of ideas that are complex and intertwined from different perspectives. The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition.

The concept of combining computers, sensors, and networks to monitor and control devices has existed for decades. The recent confluence of several technology market trends, however, is bringing the Internet of Things closer to widespread reality. These include Ubiquitous Connectivity, Widespread Adoption of IP-based Networking, Computing Economics, Miniaturization, Advances in Data Analytics, and the Rise of Cloud Computing. IoT implementations use different technical communications models, each with its own characteristics. Four common communications models described by the Internet Architecture Board include: Device-to-Device, Device-to-Cloud, Device-

to-Gateway, and Back-End Data-Sharing. These models highlight the flexibility in the ways that IoT devices can connect and provide value to the user. If the projections and trends towards IoT become reality, it may force a shift in thinking about the implications and issues in a world where the most common interaction with the Internet comes from passive engagement with connected objects rather than active engagement with content. The potential realization of this outcome – a "hyperconnected world" -- is testament to the general-purpose nature of the Internet architecture itself, which does not place inherent limitations on the applications or services that can make use of the technology.

B. AUTOMATION SYSTEMS

1) Detection of Passenger Count

Public transportation vehicles have special requirements for automatic door monitoring. Pepperl +Fuchs has a wide selection of sensor systems for automatic doors that will satisfy virtually any application requirement.

ProScan is uniquely capable of monitoring wide thresholds of the automatic doors on public transportation vehicles with an array of 12 infrared light beams. Its distinctive auto-teach capability allows sensing in constantly changing environments, and the ProScan's sensing field is easily customized for a wide range of automatic door systems. It is certified in accordance with the German Train Standard EN50155.

Detection of people in public transport [18-29] vehicles doors is dependable and versatile with the Top Scan door sensor. Modular sensors fit into a track and are readily set for beam position and angle, operation modes and left or right edge monitoring. It is frequently used to detect persons in pedestrian, bus, and train doors.ML29 series miniature thru-beam photoelectric sensors.

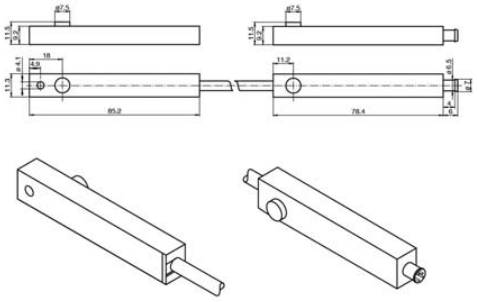


Fig: 1) Photoelectric Sensor ML29 series

2) Global Positioning System

GPS module helps us to get an accurate data of the current position [12] .It gives accurate data of latitude position, longitude position, altitude and many more other data. The hardware interfaces for GPS units are designed to meet NMEA requirements. The GPS receiver provides data in NMEA 0183format with a 1Hz update rate [9]. This data is present in 5 different strings .The latitude and longitude data are present in the GPGGA string. The extraction of the latitude and longitude data is the foremost thing done, and the resulting longitude and latitude data is stored in an array. The details of how it has been done are discussed in the forthcoming topics.

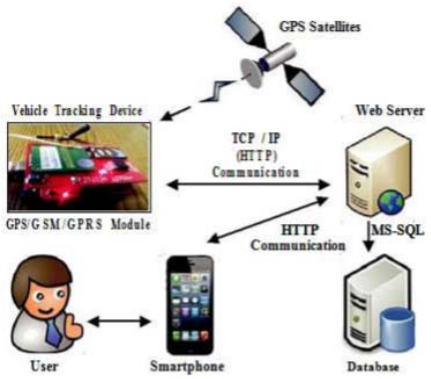


Fig: 2) GPS Working Overview

3) Wireless Communication

At the Internet of Things Conference, Libelium launched a Bluetooth Low Energy (BLE) module that

connects Waspmote sensor nodes to smart phones, tablets, and all other BLE compatible iOS and Android devices.

The **Bluetooth 4.0** wireless protocol, also known as **Bluetooth Low Energy (BLE)** or **Bluetooth Smart**, offers low-energy power management for short-range wireless connectivity that is location-aware, and context-aware. Integrated with Waspmote, Libelium's BLE module allows sensor devices to function as real time location systems, with encrypted data transactions.

Fig: 3) Bluetooth 4.0

The principal function of Libelium's Waspmote BLE module is to broadcast **data advertisements**, or **iBeacons**, that allow sensor data to be transmitted without the need of a previous pairing process. BLE allows any device to connect to the Internet with a **smartphone or tablet** that bridges data to the Cloud through the Wi-Fi or 3G radio available in the mobile device.

A key IoT-enabling platform, Waspmote connects any sensor, using any wireless communication protocol, to any Cloud platform. In addition to Bluetooth Low Energy module, Waspmote interfaces with six radio protocols—including Wi-Fi, ZigBee, 802.15.4, NFC, 3G, GPRS—and allows to switch between any two of these technologies as needed.

"We see Bluetooth Low Energy and Bluetooth Smart connectivity as an efficient, energy-saving option for everyday objects and new IoT applications in categories such as home automation, healthcare, retail mobile tracking, and security," said David Gascón, CTO at Libelium.

Technical Characteristics – Libelium Bluetooth Low Energy Module

Key Features	Why it Matters
Protocol: Bluetooth 4.0 / Bluetooth Smart RX Sensitivity: -103dBm TX Power: [-23dBM, + 3dBm] Consumption: Sleep mode (0.4uA) / RX (8mA) / TX (36mA)	BLE features ultra low power consumption that allows devices to remain in service for years.
AES 128 encryption used in master/slave mode.	BLE allows both encrypted paired transmissions and quick broadcast data transmissions between sensor nodes and smartphones.
Accurate RSSI interpretation and timing response.	Libelium's BLE module is ideal for real time indoor localization applications and mobile tracking where GPS cannot be used.
CE / FCC / IC certification; Japan and Korea qualified	Libelium's Waspmote BLE module is certified and ready for deployment in any country in the world.

Fig: 3) Characteristics of Bluetooth Low Energy Module

C. SENSOR TO MOBILE PHONE TO CLOUD

In many applications, the sensor just needs to connect to a mobile phone instead of connecting directly to a Wi-Fi router. The main reason for this is to allow the mobile-phone user to interact directly with the sensor before sending the information up to the cloud. Another reason is that some applications, like a wireless earphone connected to the mobile phone, don't need to go any further than the phone.

These applications are served by the Bluetooth standard, which was created in 1998. It was added to the 802.15.4 standard in 2003 but continues to maintain its own independent working group. It works in the same 2400-2483 MHz license-free band used by one of the Wi-Fi bands.

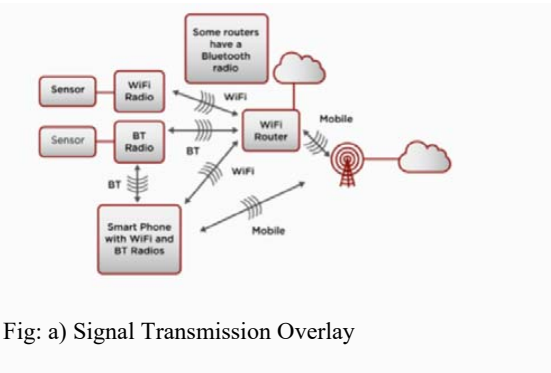


Fig: a) Signal Transmission Overlay

D. SOFTWARE PACKAGE

A Mobile application as well as a Web Application is developed that would act as the presentation and the application layers of the proposed model with mobile phones and personal computers being the interfaces to end customers.

The Android application brings out the proposed model's advantage to its fullest by enabling passengers to know the estimated time schedules and bus routes along with payment facility promoting paperless transactions. It provides an application framework to monitor and manage bus ticket booking system. The Android application uses Firebase Database which is a Cloud based Service. Data from the database is fetched and uploaded as JSON format. The User Interface renders ambiguity and facilitates easy navigation to options that meet the needs of the customers.

The Web application simply helps the user to monitor and make pre planned decisions based on real time data from the transport driver's mobile phone device. The decisions include payment management portals too.

Database layer is handled by cloud based database service FireBase, which is a platform for web and mobile development. It provides real time database and analytics to help the business administer better decision for a more cost effective model.

It is useful for the following reasons:

1) Strong user-based security
2) Optimized for offline use
3) Build server less apps
4) Collaborate across devices with ease
5) Real time syncing for JSON data

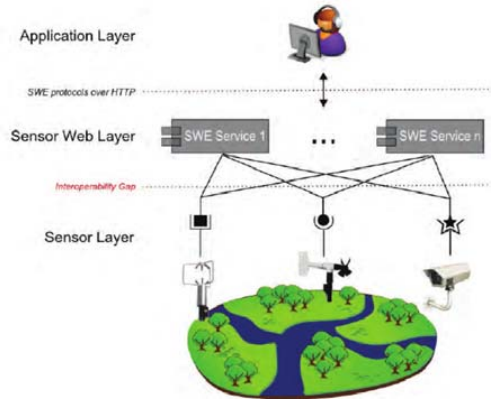


Fig: d) R/3 Modal of the Proposed IoT Architecture

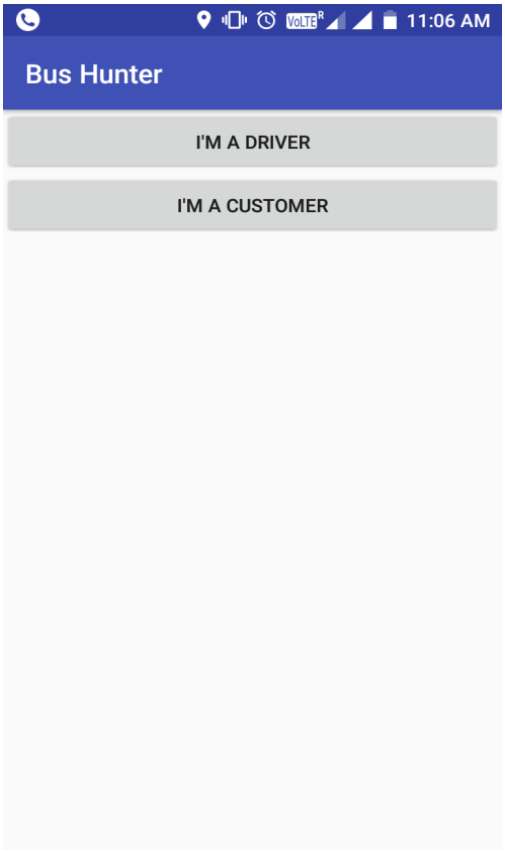
E. CONCLUSION

In this view the traffic management system on the road not as an individual problem, but as a global issue which needs to be accepted in a discreet manner. This paper given an efficient structure of IPTM System that dynamically tracks the location of the bus and update the position to the users. The measurements are updated at regular intervals, every time the bus module sends an update to the server. It distributes this information on demand, to passengers who send request using a smart phone application. The issues with traffic can be constrained as more people will opt for the efficient and economical public transportation as a medium of travel on a frequent and regular basis. With the information on demand service, the drivers can plan their journey well in advance, hence saving a lot of time and making the individual more productive. The commotion of the next arriving bus terminal is also solved by the in bus display module which will give details of the route at regular intervals. To conclude, this proposed system assists commuters, users and also the administrators of the transport system in a very convenient manner.

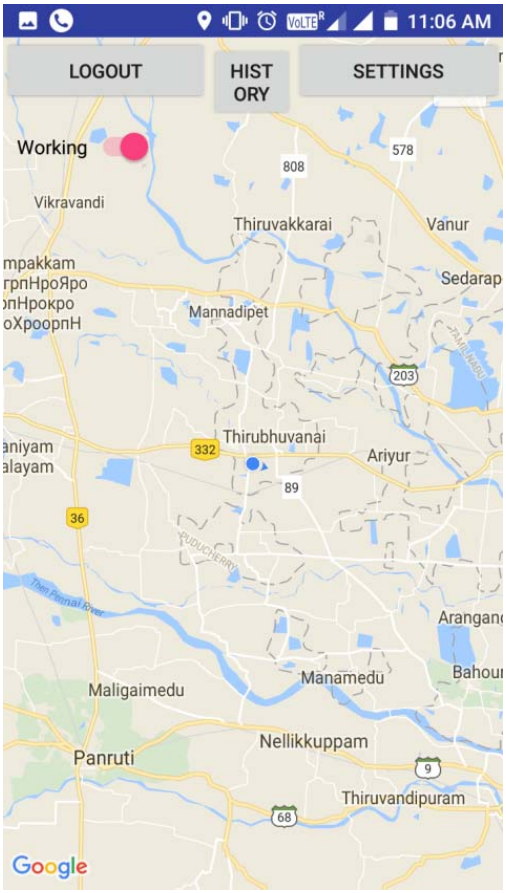
F. FUTURE WORK AND ENHANCEMENT

Future work on this project includes making the GUI more simpler and which can make use of mobile phone interface to take input from cell phone gateway and reply on the mobile phone to the user. Also it includes the development of a feature which alerts a user about the Traffic information. Based on the Traffic information , We can provide the customer to know more about the timing of the buses in real-time.

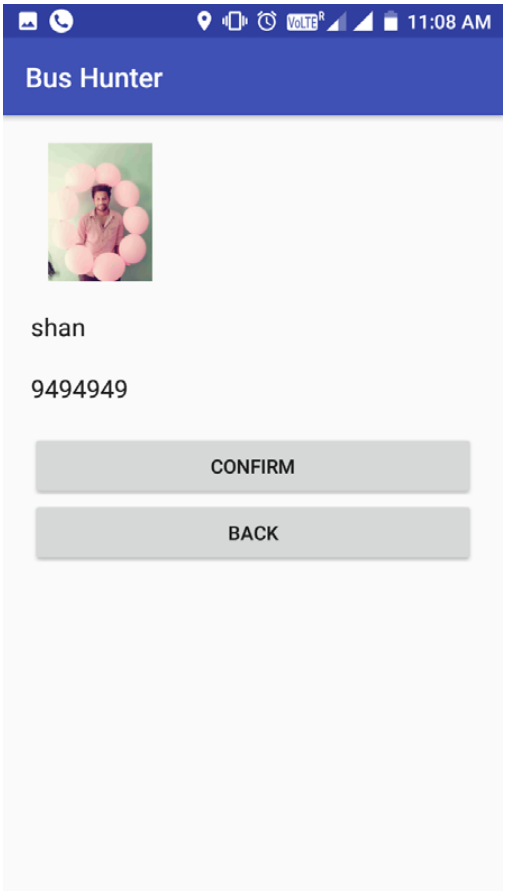
G. IMPLEMENTATION AND DESIGN



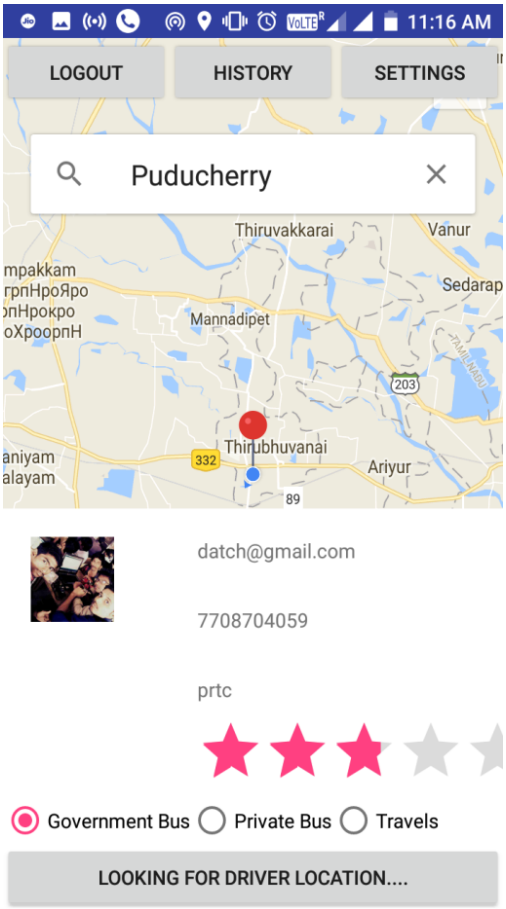
H. ROLE SELECTOR



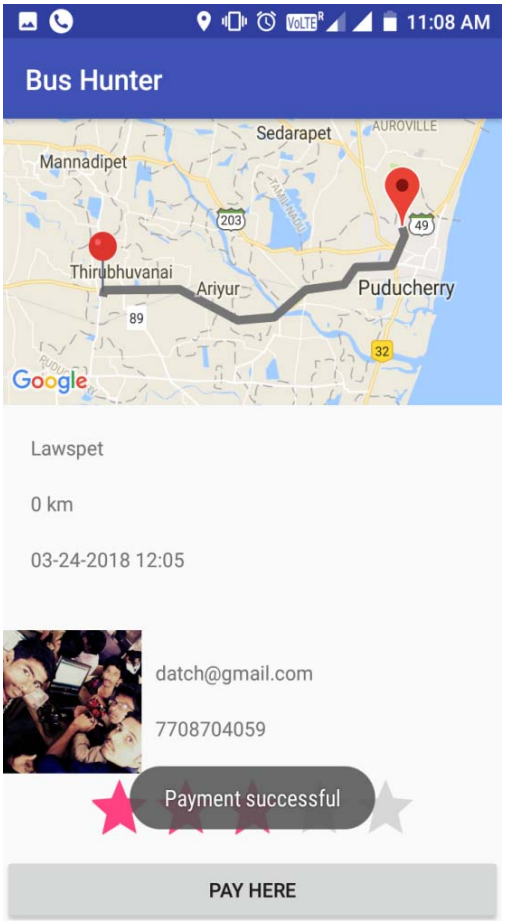
I. DRIVER HOME PAGE



J. CUSTOMER'S PROFILER



K. MATCHING TO NEAREST DRIVER



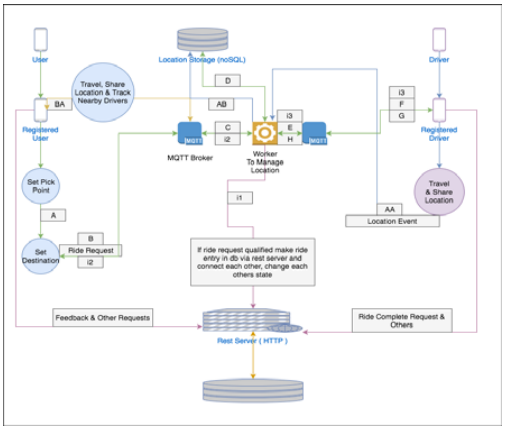
L. PAYMENT HISTORY

Algorithm

requestService = radioButton.getText().toString(); requestBol = true;

String userId = FirebaseAuth.getInstance().getCurrentUser().getUid(); DatabaseReference ref = FirebaseDatabase.getInstance().getReference("customer Request"); GeoFire geoFire = new GeoFire(ref); geoFire.setLocation(userId, new GeoLocation(mLastLocation.getLatitude(), mLastLocation.getLongitude())); pickupLocation = new LatLng(mLastLocation.getLatitude(), mLastLocation.getLongitude()); pickupMarker = mMap.addMarker(new MarkerOptions().position(pickupLocation).title("Pickup Here").icon(BitmapDescriptorFactory.fromResource(R.mipmap.ic_pickup))); mRequest.setText("Getting your Driver....");

M. ARCHITECTURE DIAGRAM



Consider the above architecture diagram. Lets say user **X** comes in. After successful registration and verification **X** will share location with system and ask for nearby driver to view in app. Follow chain (<- BA ->). Same thing for driver as well. But the difference is driver location will be saved in database. Now user **X** wants to make a ride. **X** will set pick point -> Set Destination -> This data will be send to Worker via MQTT broker (A -> B -> C). Now worker will search in database nearby drivers of pick point. If worker finds some driver nearby, worker will send request to drivers via MQTT (E -> F). If the driver **accept/cancel** the request that will be send back to worker (G -> H). Now worker will make a ride entry in SQL database via Rest Service (i1). At the same time will notify user **X** (i2) and driver (i3). User and driver is connected now.
Driver will goto pick point and pick the user , start the trip and drop to destination. At the end of trip driver have to calculate cost and few other tasks that will be served by restful API. Besides user will provide feedback thats via restful API too. There could be other tasks too but is not considering here.

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