CAIR

CENTER FOR ADVANCED IOT RESEARCH

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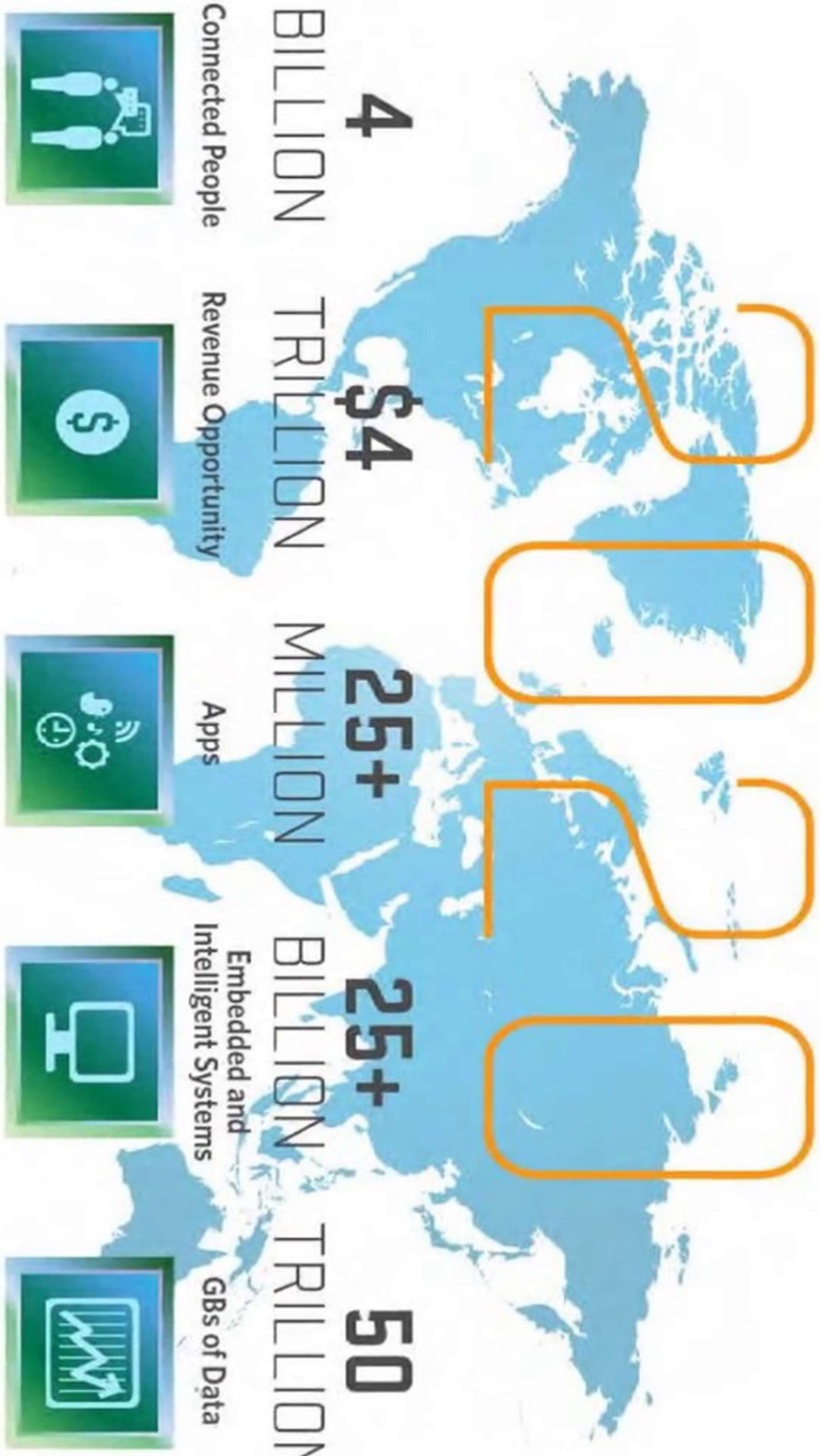
Internet of Things is the leading technology of future which is influencing our lifestyle from the way we react to the way we behave. The Centre of Advanced Internet of Things Research (CAIR) is a hub for university-industry collaboration, focusing on research and hands-on investigation of IOT Technologies and its various applications .CAIR has multidisciplinary team of faculty and students from different National and International universities of engineering domain, computer science, and other disciplines working on projects allowing for a unique opportunity to explore, extend, and innovate with emerging technologies. The Center for Advanced IoT Research brings together academic researchers and leading companies to engage in thought leadership, breakthrough research and knowledge-sharing activities. The aim is to foster deeper understanding, accelerated innovation, and successful deployment of IoT and industrial analytics. The Internet of Things (IoT) represents the convergence of three major and irreversible technology trends, which are (1) embedded sensing/smart devices, (2) pervasive connectivity (including mobility and cloud computing), and (3) real-time analytics and contextual intelligence. The ability to collect and share relevant information across all levels (ranging from factory devices to enterprise systems across the supply chain), coupled with the ability to make real-time decisions, results in an unprecedented convergence of information technology and operations technology that can deliver quantum leaps in productivity and agility.

The worldwide Internet of Things market is poised to be a USD 328 billion market by 2020



RESEARCH & SERVICES PORTFOLIO

IoT Device for Meat Classification

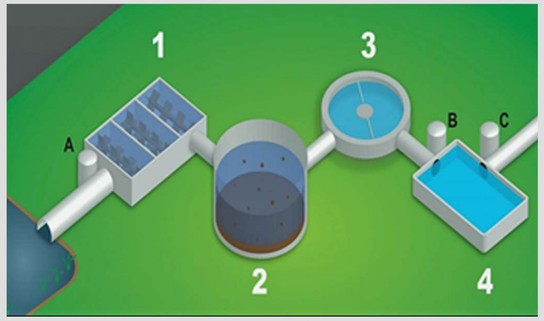
A device has been developed at CAIR that determines the quality of meat. The primary motivation behind creating this device (Electronic Nose) is to check whether or not a certain meat product (beef, mutton, fish etc.) is fresh enough or not. There seems to be an unprecedented appreciation for meat products (like beef, mutton, fish etc.) worldwide. But most of the time, the preservation techniques used are abysmal. The only way to judge the health of meat is by looking or smelling. This has a large chance for human error. Not many systems of this kind have been implemented thus far. The system implemented by us detects both the odor and flavor of the meat to separate the spoiled meat from the fresh meat and all the updates are provided to the user via smartphone.

LiFi Based IoT Network for Infant Monitoring &Security

It isn't entirely possible for the hospital nursing staff to be around 24/7. Most hospitals use Electromagnetic waves based wireless monitoring system which contain harmful radiations. To counter this, researchers at CAIR have developed a system that rectifies this by using Wireless Li-Fi (A light based data transmission system). Visible Light emits no such radiations that are harmful to children. The system uses wearable sensors to monitor the infants' health that informs parents, staff and security if any abnormal conditions occur.

Air Control Monitoring IoT Device

Air pollution is the largest environmental and public health challenge in the world today. Air pollution leads to adverse effects on Human health, climate and ecosystem. Taking the motivation to improve the health of common people, we develop a hand held IoT device to monitor air pollution contents ranging from good to hazardous. This device can be integrated with smart zones and smart city projects.



Water Quality Management System using IOT

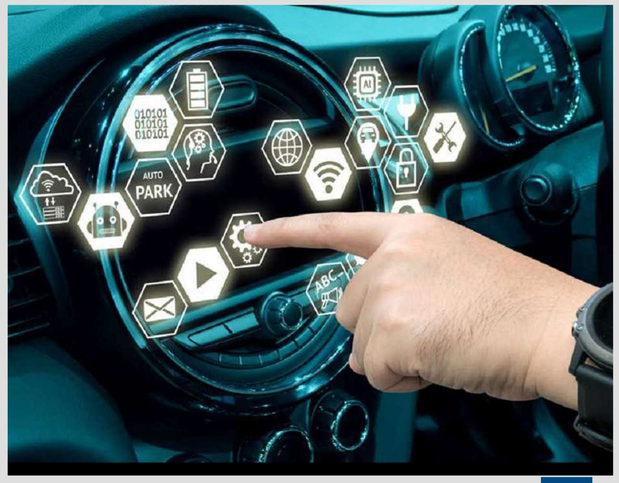
Water borne diseases claim 1.2 Million lives in Pakistan on a yearly basis.. Due to all this, knowing the quality of drinking water becomes important for everyone. The current testing methods have been proven to be ineffective. The project's aim is to rethink water quality and quantity monitoring by making it automated, real-time and convenient. The product is designed in five modules (sensors, wireless technology, algorithms, power and online dashboard (including android application)). The sensor devices for water quality monitoring are installed at critical points of water flow, using signal conditioning through proprietary algorithms and wireless transmission. Measuring of water is also integrated with wireless system. Once the data is available online, it is presented with geo- information and it detects and report anomalies for rapid action from concerned authorities. In long term, the water quality data can also be utilized to identify and predict possible trouble points and assist in remedial measures, hence improving health indicators of affected people.

Device to Device Communication for IoT Devices

In the years to come, the core demand from IoT systems will be that of higher data rates with lower power consumption. Currently, not many systems are in place to cater towards this issue. Device to device communication is a potential candidate for meeting these demands. To further explain, cognitive radio based device to device communication networks can provide a beneficial point in terms of both techniques.The prototype at hand is for short range communication (of IoT devices). It considers the system's cumulative throughput maximization problem (for a radio assisted device to device network)

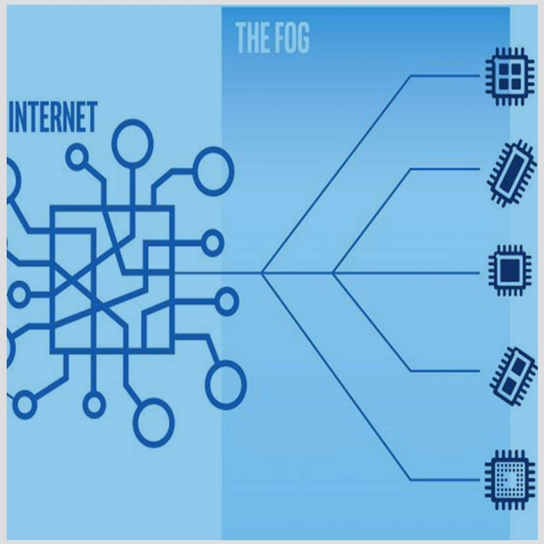
In-Vehicle Infotainment Management System in IOT Networks

Regardless of where we live, many of us have a car. And it is highly possible that the car has an in-vehicle infotainment system (IVI). These provide the user with cameras, SatNav, speakers, headrest displays and heated seats etc. But most companies provide a very dull system (which is quite difficult to navigate).
The main idea of this project is to provide a far more enhanced system. In contrast to conventional IVI systems, the IVI UI is divided into users and owners. In addition, the IVI resources are classified into personal and shared (provides betterment for the future). All this is managed by the IVI-Master using the Lightweight M2M standard.



Very High -Speed Li-Fi Communication

Wireless communication has become a crucial part of our lives (in terms of ease and comfort). Due to this, the number of users also arises (and becomes demanding for existing WLAN). Another demanding aspect is that of security (both public and tactical domains). The security aspect becomes somewhat troubling for Wi-Fi. The basic functionality of the system is the conversion of light sources into transceivers using VLC (this addresses the need of human and machine centric communication in terms of throughput, latency, security and error rate). LiFi is also far more secure than other wireless technologies, this is because light can be contained in a physical space. We can create the conditions that allow us to shut the door on our wireless data The proposed model can transmit data (Image, Video and Text) in Mbps at a range of over 10 meters. This system will overcome many of the drawbacks of traditional wireless communication systems quite easily



Optimal Transmission Using Fog-Edge Computing

IoT has become quite a popular service in the past few years and also, it has become crucial for high data rate (in real-time applications). Due to constraints (latency, bandwidth etc.), it has become challenging to support real time applications. Also the number of users are difficult to support (Might reach millions till 2020).The proposed model rectifies these issues by implementing a 4-tier architecture system for efficient processing. Under this, the cloud data is cached at fog nodes and generated data is processed near edge devices.

Implementation of IoT Management Protocol in Visible Light Communication Networks

IoT has been gaining more and more recognition in the past few years. But there are many areas to work on in this regard. To fill in these gaps, VLC is being integrated into IoT. VLC provides us with key applications/benefits i.e. more efficient. Device to Device communication, works in very low luminance (energy efficient) and higher data rates (aim of over 100 Gbps) The project uses unidirectional VLC transmissions from transmitter to receiver (for delivery of location-based VLC data). The network utilizes platform server and aggregation agents. For validation of proposed system, we have implemented by using VLC-capable LED lights and open source of one M2M .

KEY RESEARCHERS

Dr. Saleem Aslam

Dr. Saleem Aslam is an Associate Professor in the Electrical Engineering Department at Bahria University Islamabad, and is leading Center of Advanced IoT Research (CAIR). He has profound experience, Internet of Things (IoT), wireless sensor networks (WSNs) and reconfigurable & adaptive communication systems. He holds a Doctorate in Electrical Engineering from Sejong University, Korea, and has a one-year Postdoc from Queens University, Kingston, Canada. He is a member of the International Association for Engineers (IAENG) and International Association of Computer Science and Information Technology (IACSIT). He also provided consultancy to Mobile Networks Lab (MNL) Sogang University Seoul Korea on Internet of Things relevant projects. He has been serving as a vigorous reviewer of several IEEE, Elsevier and Springer Journals.

Dr. Muneeb Gohar

Dr. Muneeb Gohar received his Ph.D. degree from the School of Computer Science and Engineering in the Kyungpook National University, Korea. He has also worked as a Post-Doctoral researcher for Software Technology Research Center (STRC) in Kyungpook National University, Korea. He has served as Foreign Assistant Professor with the Department of Information and Communication Engineering in the Yeungnam University. He has been working as an Associate Professor with the CS Department in Bahria University. He has led multiple R&D internationally funded projects, those being Distributed Mobility Management in Mobile Oriented Future Internet Environment, Research of Internet Mobility Control based on ID/Locator Separation Protocols and Mobile Oriented Future Internet: Architecture and Protocol Recently, he received research funding from HEC of 3.4M. He has also strong international collaboration with prominent industrial center in South Korea, USA and UK. His current research interests include Network Layer Protocols, Wireless Communication, Mobile Multicasting, Wireless Sensors Networks, TRILL, Big Data and Internet Mobility.

Dr. Taimur Hassan

Taimur Hassan is one of the top young researchers and academicians of Pakistan who is actively involved in cutting edge research in the areas of medical image analysis, biomedical signal processing, artificial intelligence, embedded computing and Internet of Things. He recieved his PhD from NUST Pakistan and his dissertation is in the field of Ophthalmic Image Processing. Dr. Hassan has 6 years of industrial and teaching experience. Currently, he is working as a Lecturer in the EE Department, BUIC. He has been a part of many local and foreign research projects. He is also leading one project as a Principal Investigator. He is a recipient of various national and international awards. He is also serving as a reviewer in IEEE Journal of Biomedical Health Informatics [Q1, Impact Factor: 3.85], IEEE Access [Q1, Impact Factor: 3.557] and Springer Journal of Digital Imaging [Q2, Impact Factor: 1.536]. His Ph.D. research won Gold Award in Research & Development category at (P@SHA) 2016 and Asia Pacific ICT Alliance (APICTA) 2016. Recently he and his team won Gold Award in the Artificial Intelligence category at P@SHA 2018. Mr. Taimur Hassan has 30+ research publications in last 3 years having 100+ research citations with the cumulative impact factor of 24.399.