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SECP1513 – TECHNOLOGY INFORMATION SYSTEM
SECTION 02
PROJECT – PART 1 (PROJECT PROPOSAL)
[IoT - EKOKITAR MOBILE APP]

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1.0 PROBLEM BACKGROUND

1.1 Overview of Project

The decade leading up to the 21st century and continuing through the years until the present day has seen the internet revolution and subsequent proliferation of electronic devices drastically changing the global attitude towards technology. As a result, advancements and innovations in the field changed how industries operated in relation to technology, i.e. the transition to Industrial Revolution 4.0. An unforeseen consequence of this shift towards technological consumption is the sheer amount of discarded parts, scraps and whole devices that end up unrecycled either in landfills, open dumps, or collecting dust. With up to 50 million tons of electronics thrown out each year, this is not only extremely harmful to the environment, but it's also disregarding the finite nature of valuable resources that went into making them. Accounting for the global recycling trends only paints a bleaker picture, with only 13.5% of all wastes collected end up being recycled.

Our team is aware of the increasing necessity to take concrete action towards tackling the issue of waste, thus we are utilizing IoT in changing harmful habits that has become the norm using *Ekokitar*TM, a mobile app designed to facilitate the public's participation in proper waste disposal and treatment. The existing infrastructure surrounding waste collection and disposal in most parts of Malaysia is considered lacking and insufficient in terms of sustainability and management, Malaysia having 0.98 million metric tonnes of mismanaged waste in 2015 alone. This is also partly due to a lack of public interest and participation in recycling/waste management. Thus, we prioritize ease of use in our user experience, to maximize the accessibility of our services in order to encourage social change to the masses.

The goal of this project is to set up a self-sustaining business model centered around collecting people's recyclable trash and dispose / recycle/ upcycle or repair them to turn a profit. At the same time we are giving users the initiative to sort their wastes and plan responsibly how they are to dispose of it. Through the *Ekokitar*TM app, users can opt for couriers to come and collect their specified waste (by type, material, weight and size) at convenient locations (e.g.

user's address or community garbage dump) at set times of the day/week. Another key aspect of our planned operations is the drop-off collection points that are placed in logistically efficient locales. Though for certain items or remote locations, we might require a fee to cover transportation costs as well. Smartphones' ubiquitous camera, GPS and online payment functionalities allow all the parts needed for our operations to run smoothly.

We also plan on developing bilaterally beneficial collaboration with client companies and businesses that share the same vision as us and support our socio-environmental goals. Such opportunities include major food chains, shopping malls, depots, retailers etc, providing the bulk of the materials to be handled. Other collaborative efforts may involve the handling, treatment and disposal of these waste materials. Green campaigns by companies like Intel, AMD, IKEA, Nike, UNIQLO, etc might create a market for refurbished and reused materials from cotton and plastics to Nickel, Gold and Copper and everything in between.

The cloud computing infrastructure plays the most important role in the deployment of our application. Amazon Web Services (AWS), was chosen for its wide range of services that cater to every aspect of our project's development. It's most useful in handling the back-end development of the mobile application, from data storage management to networking, security features, organizational bracketisation, analytics, push notifications and user account login/creation.

1.2 Problem Statement

Nowadays, with an increasing number of populations around the world, the usage of plastic and different types of waste is also increasing. This is worrying because we just dump all the waste into the ocean and landfills and can cause a lot of pollution that will affect us in the near future. Although there's a practice in recycling among society, the data shows otherwise because only 9 percent of the world's plastic has been recycled. Next, the issue itself comes from people where they are too busy or too lazy to classify the waste product. The lack of knowledge regarding who to contact and where to throw the recycled waste become a major problem for

them. With this issue in mind, we've created an app that's user friendly to tackle this issue efficiently.

1.3 Proposed solution

Next, due to the issue of recycling limits, we have decided to create an application named *EkokitarTM* which enables our potential clients such as neighbours, relatives, family members, friends and the public to recycle their unwanted items through the delivery service. This application contains many features that can ease the users such as we will provide and repay by giving points according to the type and mass of items given. Here, the users need to make a verification first by taking a picture of the items before being collected by the rider through the application. The users must also select the sort of transportation delivery and pick-up time that they prefer, so that riders from any drop point center may prepare and pick up their products on time.

Then, the application will check and approve the submission, then it will provide a QR code scan for the user to gain points. Besides, the points that have been collected by the user can also be redeemed for vouchers that are accessible at some of the companies with which we have chosen to cooperate, such as Starbucks, Tealive, and others. These features will encourage the users to keep on recycling and compete with one another, since the points will be shown on the official "EcoKitar" social media website, and the top three ranks will be granted rewards each month.

Furthermore, if the users want to drop the recyclable products at any nearby drop point center, they can manually weigh their things before receiving a QR code from the app depending on the categories and mass of the items to gain points. The rider then will collect the items from the drop-off location and deliver them to the warehouse. Moreover, the employees who are in charge of collecting items at the warehouse will store them first before sending them to any

company such as IKEA, Nike, UNIQLO, etc that may innovate or recreate a product using the recycled items and offer it to the residents as new products.

To summarize, this application will assist users in being more flexible in recycling unwanted goods, which will have a positive impact on the globe. For instance, increasing the quantity of recycling activities can reduce incineration and save energy, which is good for the environment.

1.4 Objectives

The central objective of this recycle management application is to prepare a community to manage waste, wreckage, and items that are no longer used. To meet this objective, it is particularly important for us :

1. To promote the reuse of material waste. On the other hand, we will collaborate with certain companies that can reproduce the waste and turn it into something useful in the future.
2. To boost economic development and a higher quality of life by minimizing and eliminating the negative effects of waste products on human health and the environment.
3. To transfer data over a network and deliver enhanced customer service, improve decision-making and increase the value of the business as our service will linked to the Internet of Things (IoT) that can make it become a well-organized system

1.5 Scopes



EkoKitar Project Scope

The scope of our project is for all Malaysians. The scope of work is listed below :

- The application is specially designed for the user to recycle
- Create an application that can improve the handling process of waste and recyclable items
- Applicable to all communities wherever they are
- Various types of waste that can be collected and recycled

For the scope of this project it includes design, equipment to be used and application testing. It also involves the cost of producing the application to produce this project. This application uses Cloud Computing and IoT as well as making it more efficient, cost savings, flexibility and sustainability.

1.5.2 Project Risks and Constraints

Technological

- Inadequate testing
- Inadequate performance or excessive downtime with no service guaranteed

Resources

- Allocating or scheduling the needed resources on a timely basis for project planning, execution, monitoring and controlling might be limited at times
- Financial implications

Others

- Community rejects/dislikes the system
- Lack of adequate functionality
- Failure to achieve the quality required and/or functional requirements of the build

2.0 CLOUD COMPUTING ARCHITECTURE & PLANNING

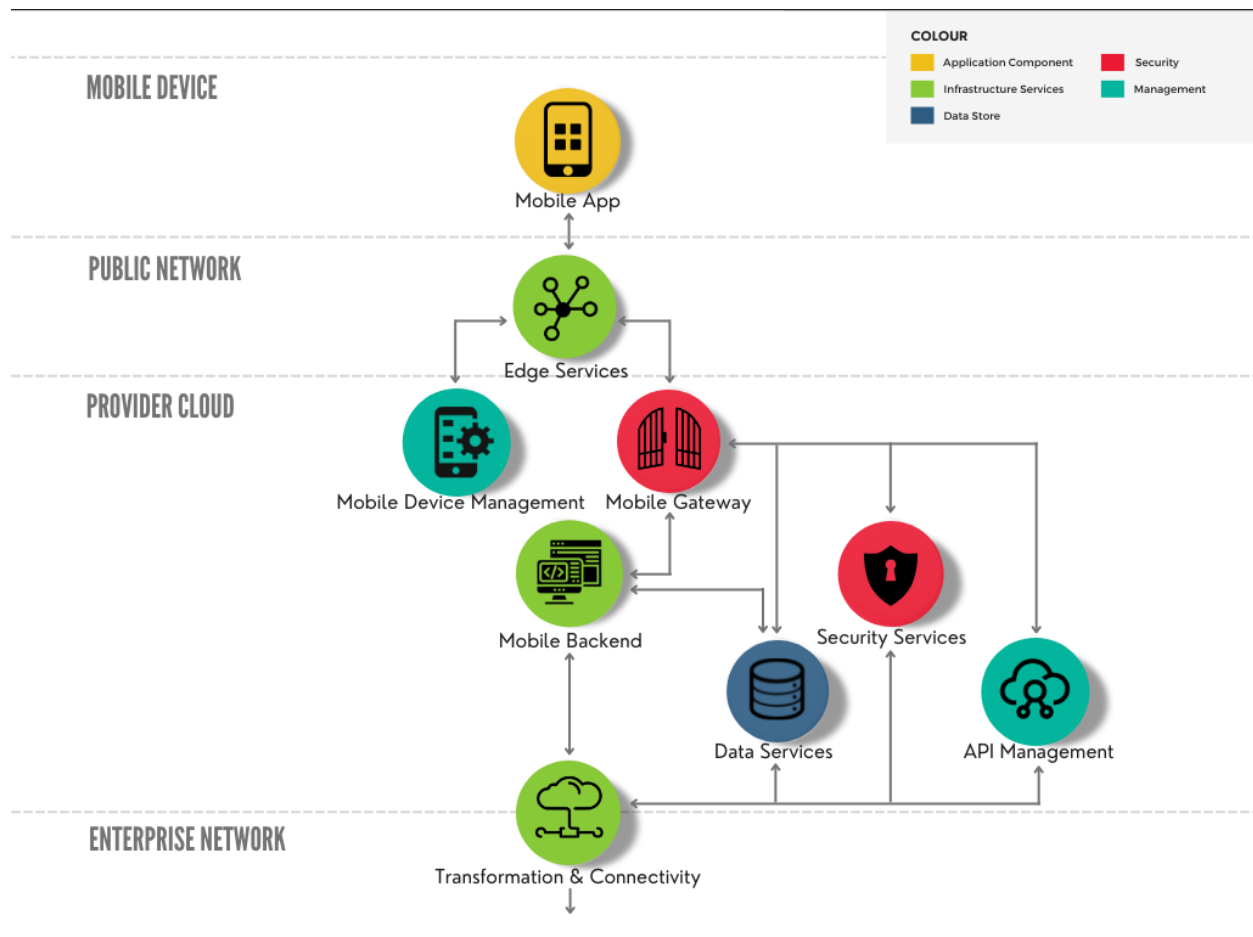


Figure 2.1 : Represents the whole structure of interrelated networks for our mobile app

Our architecture consists of 9 components that will integrate and link each other to make sure the project runs smoothly and efficiently. The 9 components are :

- 1) Mobile Devices which consist 2 components such as Mobile Application as the front-end and System Development Kits (SDKs) as the back-end
- 2) Public Network which is Edge Services that consist of Firewall, Domain Name System and Content Delivery Networks
- 3) Mobile Gateway which consist of Authentication/Authorization and Policy Enforcement

- 4) Storage is included as Back-end Provider which consist of AWS Services such as Amazon DynamoDB and Amazon S3
- 5) Security (back-end) services which consist of Amazon Cognito
- 6) Management (back-end) software such as Mobile Device Security, Device Management, Enterprise App Distribution and Device Analytics
- 7) API Management
- 8) Data Services that consist of Mobile App Data and Caches
- 9) Enterprise Network which contain Transformation & Connectivity component

The architecture we mentioned will be explained in further detail in the next segment :

2.1 Mobile Devices

2.1.1 Mobile Application

This is the main component of this architecture as this will be our head where it will engage with the user. This application will consist of many interactive buttons that will display the required information and also record any data based on what the user presses. The proposed application will be connected to backend systems to make this system work efficiently.

2.1.2 System Development Kits (SDKs)

To provide developers with necessary tools to add any functionality that mobile applications needed. It will also enable them to build standard components such as location services, logging in and many more. This will make the application more interactive and fast as SDKs usually come in all-in-one products, so there's no need to integrate with other components as it will slow down the development process. It is also an important tool for developers to access backend systems.

2.2 Public Network

A public network is one to which anyone, i.e. the general public, has access and can connect to other networks or the Internet through it. Users should be mindful of possible security

concerns when using a public network because it has little or no restrictions. For instance, edge services is one of the public network components which also includes several services.

2.2.1 Edge Services

A component that is exposed to the public internet is known as an edge service. It serves as a hub for all other services, which we will call platform services. Edge services are required to link the mobile device and its apps to the appropriate mobile gateway over the Internet, whether over Wi-Fi or mobile provider networks. These include :

- I. **Firewall** which is a device that restricts communication access to and from a system, allowing only traffic that complies with a set of policies to pass through and blocking traffic that does not. Firewalls can be implemented as standalone hardware, as a component of other networking gear like a load balancer or router, or as part of an operating system's software.
- II. **The Domain Name System (DNS)** is an integral component of modern networking because it converts human-readable domain names to the underlying Internet Protocol (IP) addresses that linked devices use to communicate with one another.
- III. **Content Delivery Networks** refers to a geographically distributed set of servers that collaborate to provide rapid Internet content delivery and minimise response time for serving resources to geographically distributed users, ensuring that material is highly available and delivered with minimal latency.

2.3 Mobile Gateway

The Mobile Gateway is the point where a mobile app connects to the solution's mobile-specific services, which often include a set of internet-accessible Application Programming Interfaces (APIs). A mobile gateway may be implemented by a common gateway to access all channels into an API ecosystem which provides authentication/authorization and policy enforcement.

2.3.1 Authentication/Authorization

Authentication/Authorization allows security services to identify, authenticate, and authorise users using a number of methods and token types. Mobile authentication services can handle a variety of token kinds, including biometric technology like voice authentication.

2.3.2 Policy Enforcement

Policy enforcement is typically handled by software or hardware serving as a gateway, proxy, firewall, or other centralized point of control in the network. Policies must first be defined, along with one or more actions that will be taken if a violation occurs.

2.4 Storage (Backend-provider)

For our app to run smoothly, we need sufficient capability and capacity to store all the data that is generated from our users and our internal operations. Suitable methods of organizing relevant data are chosen in order to optimize efficiency and speediness.

2.4.1 Amazon DynamoDB

This AWS service will solve all our storage needs. The service provides a highly resilient and scalable NoSQL database manager which can support any level of data traffic and retrieve any data that is required. It does so seamlessly, scaling to meet our actual usage amounts automatically, without performance degradation nor any downtime needed. Its range of features removes any of the administrative burdens of operating and scaling a distributed database so that we don't have to worry about hardware provisioning, setup and configuration, replication, software patching, or cluster scaling associated with managing our own databases.

2.4.2 Amazon S3

We also use Amazon S3 hand in hand with Amazon DynamoDB in providing cost-efficient cloud storage solutions for the entirety of our needs. We can store our data as objects (up to 5 terabytes in size) within resources called “buckets”. S3 features extensive

configurations, we can enforce data access controls, secure data against unauthorized users, run big data analytics, monitor data at the object and bucket levels, and view storage usage and activity trends across our organization (analytics) through its sub-services such as S3 Inventory, S3 Access Points, S3 Storage Lens, S3 Storage Class Analysis, etc . We can customise it to support our specific use case, enable cost efficiencies, enforce security, and meet compliance requirements.

2.5 Security Services (Backend)

User data in any application can differ, but if the data is stolen and leaked, it can cause irreversible damage. So, that's why our application also provides security services. Security services modify management of access in order that solely approved users will firmly access mobile cloud services. This element additionally provides protection of knowledge across mobile devices and cloud services, and allows visibility to own unjust counterintelligence across cloud and enterprise environments.

2.5.1 Amazon Cognito

Amazon Cognito is an AWS service that helps you to create completely unique and steady sign-up, sign-in, app authentication and get entry to manipulate on Internet and cellular apps for users. This carrier is well suited with websites that require sign-ins which include Facebook, Google, Amazon, etc.

2.6 Management (Backend)

Mobile Device Management (MDM) is designed to enhance employee productivity while simultaneously maintaining corporate security by empowering our enterprise workforce with the power of mobility. For instance, it also will help to keep record of enterprise owned devices and monitor devices that connect to corporate networks by using the management agents on the device. Besides, MDM software can also help to limit the risk of data loss, restrict unapproved

software installation, and block malicious access to business data and networks via the mobile devices. There are some features that MDM software can provide:

2.6.1 Mobile Device Security

Here, the software will specify enterprise security policies that must be applied to devices by engaging with the Security Services. This comprises regulations for gaining access to corporate networks, password standard, encrypted documents and some other things. It also will protect your network by granting different levels of access to different devices to provide a secured access network.

2.6.2 Device Management

The software will give the enterprise the ability to view device usage across the organization, and will also allow administrators to perform actions such as add, remove, and erase across all of those devices. In addition, the software can also ensure that users' devices are compliant with policies by configuring users' profiles to enact policies for Wi-Fi, VPN, and other parameters. It is used to troubleshoot issues on users' devices where it concludes on remotely controlling and viewing mobile devices during the real-time.

2.6.3 Enterprise App Distribution

In MDM software, the enterprise app distribution will give the ability to the host enterprise and to distribute enterprise apps to mobile devices. If the enterprise apps are not being deployed into the public app stores such as iOS, Android, macOS and so forth, the enterprise catalogs will be required, so then it will be easier to manage app distribution that is easier to access.

2.6.4 Device Analytics

This mobile device analytics will improve data quality by ensuring that identities and other essential data components regarding those entities are correct and consistent across the organization. It will boost the MDM solution's capabilities by delivering comprehensive and vital

data to optimize device performance, user productivity, and uptime. In addition, mobile device analytics can also act like a virtual reflection showing device performance.

2.7 API Management

API management capabilities publicize the mobile gateway's access to available services endpoints. It offers API discovery, catalogues, connections between supplied APIs and service implementations, and administration tools like API versioning. Moreover, an API management system allows a company to ensure that both the public and internal APIs it develops are usable and safe. The majority of API management systems will allow the users to perform the following tasks such as API Discovery/Documentation and Management.

2.7.1 API Discovery/Documentation

Allows mobile developers to find and use APIs in a secure manner. Most APIs have discovery documentation available for certain versions. The Discovery Document for each API specifies the API's surface, how to access it, and how API queries and answers are organized. API-level features such as an API description, resource schemas, authentication scopes, and methods are included in the information provided by the discovery document.

2.7.2 Management

API management will provide a management perspective of API usage by mobile apps, based on data from the mobile gateway, backend, and other sources. APIs should be managed from start to finish, from design to implementation through retirement.

2.8 Data Services

Data is often stored in a format that allows mobile apps to access it quickly, and it may include extracts of business data which are possible to be modified. As for this application, data services will operate as a middleware, discovering and delivering data from a variety of sources where the programme demands independently. For instance, data services play an important role

in governance by centralizing metrics, monitoring, version management, data reuse, and enforcing data visibility and access regulations.

2.8.1 Mobile App Data

Designed with consideration for the demands and constraints of the devices and also to take advantage of any specialized capabilities they have. Moreover, mobile app data is simply data stored in a format that mobile apps can consume quickly and conveniently. The database that mobile apps use is usually MySQL which is an open source, multi-threaded and easy to use SQL database. There are general criteria to select the right mobile app such as speed and scale, data modeling, data security and others.

2.8.2 Caches

The goal of caches is to provide the ability for mobile apps to cache data for faster access. The information (caches data) will get cached on your devices after you visit an application, and the developers to improve your online experience. In fact, most devices are described by a so-called computer memory hierarchy, which describes how they store and access data. This cache memory will benefit the users in terms of improving speed and performance of the users' data, securing data by restricting the hackers from conducting an assault that puts data security at risk and protecting users' data privacy by clearing cached data.

2.9 Enterprise Network

An enterprise network is made up of physical and virtual networks and protocols that connect all users and systems on a local area network (LAN) to data centre and cloud applications while also allowing access to network data and analytics. It also provides end users and applications with quick and dependable connectivity.

2.9.1 Enterprise Transformation & Connectivity

The enterprise transformation and connectivity component provides a secure connection to enterprise systems as well as the ability to filter, combine, or modify data or its format as it moves between mobile and enterprise components. When the native format of enterprise data isn't suitable for transfer to mobile devices, data transformation may be required.

3.1 BENEFIT OF PROPOSED SYSTEM

Our mobile application services will be giving you few benefits such as optimization of routes and expenditure, monitor the application services, observing collection process, client have access to exclusive area and 100% online solution.

3.1.1 Optimization of routes and expenditure

With the help of Google maps and other GPS technology, the rider will be able to reduce the time to pick the recycled items and at the same time can reduce the usage of fuel. It will also reduce human error because of the precision of computer algorithms that help calculate and choose the best route to maximize productivity. From these benefits, it's clear that operational costs will greatly reduce with the help of technology.

3.1.2 Monitor the collection team's schedule and the services that have been provided

An app is also capable of organizing all the storage, making it easy to validate the waste input and output of their inventory, as well as providing access to various types of management reports from the waste management. Moreover, it can also determine the collection with photographic evidence of each waste by using the advantages of 4th IR technologies which is the Internet of Things (IoT) where it can determine whether the items are included in the predefined categories of our application systems.

3.1.3 Observing the collection process from each client in real time

Accompanying in real time the results of your company and the daily performance of your collection team. Additionally, this application services could check the successful collection and the pending collections, as well as the events by client, collaborator, date and hour. The clients are receiving automatic notifications based on the collected data such as user's point rewards, order accepted, leaderboard ranking and others.

3.1.4 Clients have access to an exclusive area where they may request collections and track the waste they have gathered.

This project will create a centralized recycling collection system with the help of algorithm and machine learning technology. It will greatly help clients to find and buy recycled items in just one place. It also provides an eco-conscious solution to waste disposal and/or leasing new life into unwanted belongings by ensuring professional handling and management of said waste with sustainability in mind either through recycling or upcycling processes.

3.1.5 100% online solution, accessible to anyone, anywhere.

Democratizes recycling and incentivises people to properly dispose of their waste materials by offering online perks and bonuses such as vouchers, offers, discounts and monetary compensation. Users can save money to buy food and other services by redeeming the vouchers they earned based on their collected points.

3.2 Summary of Proposed System

Our proposed IT system will provide the general public with an alternative and intuitive solution for the act of recycling waste materials and discarded items. We intend to integrate

waste management solutions as well as generate value from collected materials using a combination of IoT enabled functionalities and through collaboration with third party companies. This collaboration will provide a reward system for users to encourage them to be more engaging in recycling.

Our system revolves around the accompanying mobile application that will allow users residing in selected regions a number of different services such as waste types for user to select different types of waste to recycle, point system for user to redeem voucher and many more exciting rewards, camera scanner feature that can scan the QR code provided at drop point area to claim rewards and also to verify the recycled items, ranking system for user to compete with their friends, GPS feature to help our rider locate precise location of the drop points.

The benefits of our services include monitoring and observing data collection helps to organize all of the storage and team performance for a better result. In another way, the Internet of Things (IoT) also helps to develop businesses in a real-time view of how our systems work, providing information on everything from machine performance to supply chain and logistics-related operations. Apart from that, our services are also user-friendly in which we have provided a drop point hub to drop off the recycled items for those users who are unable to use the mobile application or do not have internet access.

The limitations of this project consist of 3 aspects which are Technological aspect, Resources aspect and others aspect. For technological aspects there exist inadequate testing and performance. Next, for the resources aspect there's financial implications and a limited amount of resources for project planning, execution, monitoring and controlling. Lastly, There might be some communities who dislike the system and lack adequate functionality. There's also another limitation where our company might not achieve the desired requirement of our application.

To conclude, this application also provides employment opportunities during this pandemic phase which can give a steady stream of income to the community. As a result, it can bring them a sense of security, stability and it makes life easier.