Smart Life Saver System for Alzheimer Patients, down Syndromes, and Child Missing Using IoT

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ABSTRACT--- ***Mobile applications are growing very fast. it is used now in every fields in our life as it provides solutions for many problems. Now a day's child security is an important area of concern. So, we think to transform the traditional way in Search for missing persons to smart way to avoid many problems that face families and government in missing people problem using many technologies. This model is developed to rectify the worries of parents regarding their child security.***

This paper proposed a model for child safety through smart phones that provides the options such as Near-field communication (NFC), Quick Response Code Reader (QR), and Optical character recognition (OCR) reader to save people life or from missing situation. In this scenario, our proposed model provides the maximum security and ensure finding missing people. our model is connected with a web site via a cloud platform as a service, and manufacture the IoT device to store people information. This proposed system is validated by testing on the Android platform

Keywords--- IoT, Cloud Computing, NFC, Imbedded Systems, Mobile Application, Alzheimer Patients, down's syndrome

1. INTRODUCTION

Human lives are extremely respected in all the world. every day we see problems such as child missing and their family who are worried about them. there are about 8 million children lose in 2016., also the number Alzheimer's patients which about 46 million persons, and down's syndrome which about from 3000 to 5000 children are born each year over the world, and also the road accident which about 1.3 million people die in road crashes.

As the popularity of missing people increase as the needing of protect them .so, to improve the security and safety for missing people, and to solve this problem, we develop a mobile application to serve customers' requests and save people life

or from missing situation. The application is based on a QR code, NFC, and Optical character recognition (OCR) reader technology that is already in place and used globally in many applications including marketing, archiving, asset tracking and document management among others.

. This paper is focused with the safety of children. Today child safety is an important issue across the world as child crime is quickly growing across the world in this paper we have discussed how a smart phone provides safety and monitoring for the parents so that they can easily found their children according to their requirement.

Our solution is IoT application that help in accident and missing situations

The Challenges to produce an effective system, many parameters should take in our consideration such as cost reduction, which means saving the memory space and requiring a store area as small as possible. The system should be easier for each user and does not need a user with special skills to navigate it. Also, availability is required in the system. Availability is referred to anyone can access system anytime and anywhere. So, we have a challenge to make the system more active, easier, and cheaper.

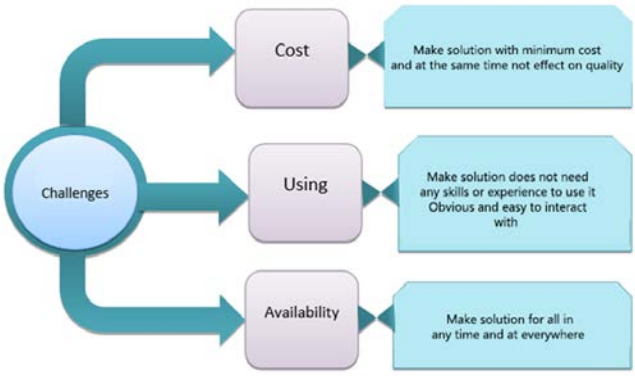


Figure 1: the Challenges for building our system

To give more prospective about the research, this section discusses the basic terminology for building the system

1.1 Mobile and cloud Computing

Mobile devices (e.g., smartphone, tablet pcs, etc) are progressively becoming an vital part of human life as the most effective and suitable communication tools not restricted by time and place. these smart phones, providing lots of features which make our life so simple and easier.
The analysis of the impact of mobile computing on the various services shows how the mobile computing has changed each service. As mobile computing has become more popular over the past decade, it has been under continuous development with advances in hardware, software, and network. Mobile computing has various applications in our everyday life[1-3]. Use of this technology has become a fundamental skill. With mobile computing we can check our email messages, our bills, our bank accounts, and our other private information just by using a mobile phone or laptop anywhere. All the functionalities obligate each exchange data to make it safe and immune from any attack. Mobile computing services have simplified our lives. Every day we get attached to a new device that includes a lot of functionalities and is based on mobile computing, as examples, BlackBerry from RIM, iPhone from Apple, Net-Book, etc. the most popular operating systems such as:

1. Symbian
2. Windows
3. Palm OS
4. BlackBerry
5. iOS
6. Android

Market share for mobile phones as shown in the following figure. That is the reason for selecting android operating system. android operating system is that now days millions of users are using smart phones.

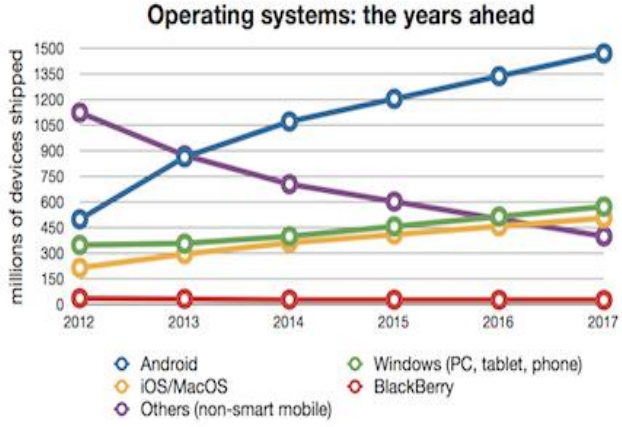


Figure 2: Market Share for Mobile Smart Phones

cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. Cloud computing, also on-demand computing, is a kind of Internet-based computing that provides shared pool of resources and data to computers and other devices on demand [4][5].

1.2 IoT Imbedded technologies

The Internet of Things is the intelligent connectivity of physical devices driving massive gains in efficiency, business growth, and quality of life[6][7].
allows objects to be sensed and controlled remotely across existing network infrastructure.

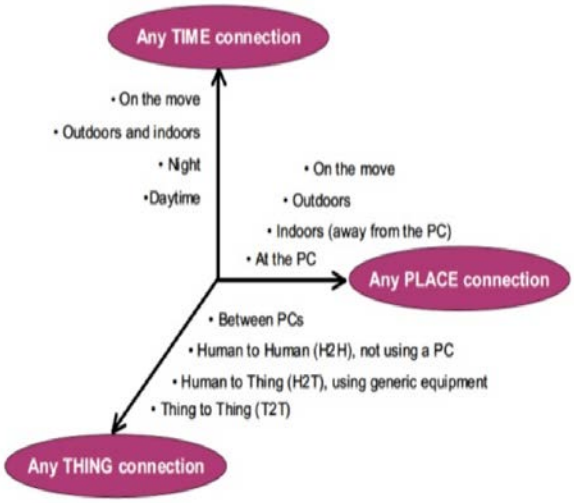


Figure 3: IoT dimensions

Imagine a world in which every device in the home, workplace and car are connected [7-9]. A world where the lights automatically turn on when the car approaches the driveway. the coffee starts brewing when the morning alarm goes off and the front door automatically unlocks when approached by a member of the household, but stays locked when a stranger arrives on the front step. That is the type of world the Internet of Things can create.
The Internet of things are driven by a combination of three component

1- Sensors & Actuators
   a. **Sensors**: Detect real-world environment.
   b. **Actuators** : Change real-world environment.

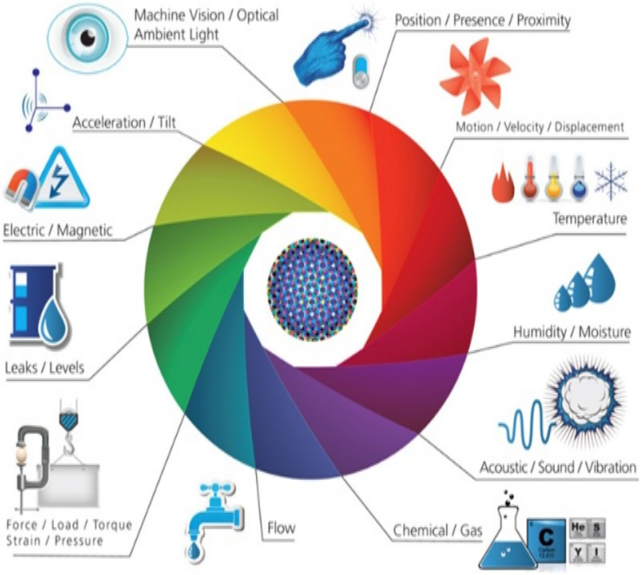


Figure 4: IoT Sensors and Actuators

2- Connectivity

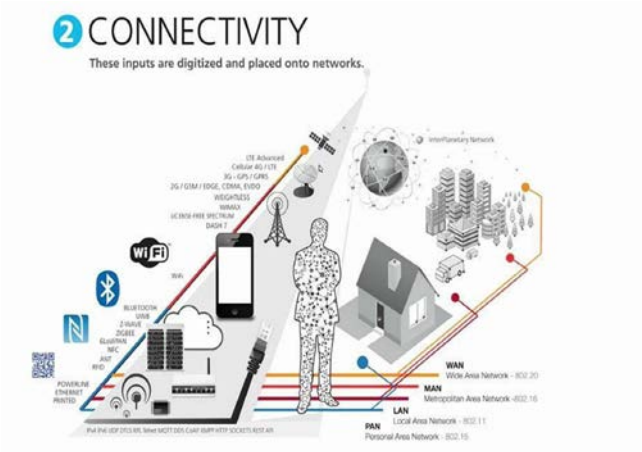


Figure 5: IoT Connectivity options

3- People & Processes (Management)

1.2.1 IoT Technologies

Specifications	NFC	RFID	Bluetooth	WIFI
Maximum Coverage Range	10cm	3meter	100meter	100meter
Frequency of operation	13.56MHz	varies	2.4GHz	2.4GHz,5GHz
Communication	2-way	1-way	2-way	2-way
Data rate	106,212,424Kbps	varies	22Mbps	144Mbps
Applications	credit card related payments, e-ticket booking	EZ-Pass, tracking items	communication between phone and peripherals	wireless internet

Figure 6: IoT Technologies options

1.2.2 Near Field Communication versus Bluetooth

Bluetooth and near field communication share several features; both being forms of wireless communication between devices over short distances. NFC is limited to a distance of approximately four centimeters while Bluetooth can reach over thirty feet [10].

NFC technology consumes little power when compared to standard Bluetooth technology. Only when NFC has to power a passive, unpowered source such as an NFC tag does it require more power than a Bluetooth transmission.

One major advantage of NFC over Bluetooth is its hassle-free approach to connections. With Bluetooth, you need to turn it on first, find the device, pair them together, then you can do what you want to do. With NFC, bringing the two devices within range is enough to facilitate the communication between the two [11].

Lastly, there is the ability of NFC to work with passive RFID tags like the ones used on dogs. So, if implemented properly, you can use your Smartphone to read the ID of a lost dog to identify its owner. Bluetooth is not compatible with RFID and cannot work in the same way [12].

2. RELATED WORK

To give more prospective about the performance of the compared methods, this section discusses the results obtained from other resources.

Lee, Tewolde, and Kwon [13] designed an efficient system for tracking the movement of equipped vehicles at any location and time. They used the popular technology that combines a smartphone application with a microcontroller.

This in-vehicle device works using GPS (Global Positioning System) and GSM (Global System for Mobile Communication)/ GPRS (General Packet Radio Service). A microcontroller is used to control GPS, GSM/GPRS modules. GPS is employed in order to give geographic coordinates at regular periods, whereas GSM /GPRS transmit and update the vehicle's location. A smartphone application provided with Google Map was developed to monitor the vehicle's location displaying the vehicle on the map. The study reveals that users can use a smartphone application to monitor a moving vehicle on demand and its location, determining the estimated distance and time for the vehicle to arrive its destination.

Rajai and Ashok [14] carried out a study adopting telematics module that uses the Global Positioning System (GPS), and Global System for Mobile Communications (GSM) modem. This application is used by users in order to track their vehicles remotely through a local mobile network. Evidently, the researchers developed a system which utilizes GPS in order to obtain a vehicle's coordinate and transmit it using a GSM modem. Consequently, this modem locates the vehicle's place transferring it to the user's mobile number. Moreover, this system enables users to identify the accident by means of the range of vibration. It is worth mentioning that the main hardware components of this system include L80- M39 GPS receiver module, SIM900A GSM module, LDT0-028K vibration sensor, RF Transmitter and Receiver, and Arduino Mega 2560 microcontroller. The study has found that telematics module has ability to demonstrate the feasibility of near real-time tracking of vehicles, improving customizability, global operability and cost.

Kolaskar*et al.* [15] discussed the design and the implementation of real-time and offline GPS tracker using Global System for Mobile Communication (GSM), Arduino, Storage Card (SD), and SIMShield. This system has significant application for vehicle security; therefore, when a registered user makes a call on a number which is provided with a GSP application attached to Arduino, the user then receives the location coordinates. Furthermore, the received data will be automatically stored on SD at the same time in case of existing offline geographical location.

Saxena*et al.* [16] developed an anti-theft system that does not only stop the lost vehicle but tracks its location by using GPS, GMS as well as a web application. This system is put into the sleeping mode when the owner or any authorized person drives the vehicle or operates it remotely. However, when the theft is discovered, the responsible people send SMS to the microcontroller; and then, the control signals are issued to stop or cease the engine. In order of restarting the vehicle, the system will be reset. This application makes the vehicles more secure and there eliminates theft.

Kalaiarasi*et al.*[17]conducted an experimental study on vehicle securitizing using an embedded system consisted of GPS, GSM, Arduino microcontroller, Mobile SMS, Internal Memory, and Internet Connection. Their application monitors the speed as well as stoppage points in real-time and calculates the distance and the duration of stoppage. It also optimizes fuel cost and improves the efficiency by decreasing the operational costs. To monitor the vehicle on demand, Arduino is interfaced serially to GSM Modem and GPS Receiver. A GSM modem is used to identify the position of the vehicle, and the GPS gives details about the latitude and longitude of the vehicle and many parameters. The data is sent to the mobile and then stored on the internal memory.

Other researches will be found in [18-22]

Also, there are Product for finding missing peoples such as **Shoes for Alzheimer patients includes the following** Services:

- Use the shoes design to can wear it.
- The shoes track the Alzheimer patients anywhere.
- The shoes connected to dashboard to can view the patient location.

The second Product is **Tracker includes the following Services:**

- Is small sensor like the keys model?
- The sensor connected with mobile application to view the location.
- The tracker alarm when we closer from it.

2.1.1 Features' Check List:

The following table contains a comparison between the previous two product , and our proposed model "according to some options, the (+) means that this option exists in this product and the (-) means that this option doesn't exist in this product.

System Name / Feature	**Proposed model**	**Shoes**	**Tracker**
Store information	+	-	-
NFC Technology	+	-	-
Tracking	-	+	+
Offline	+	-	-

Band Aid	+	-	-
Battery	-	+	+
GSM Connection	-	+	+
Face Search	+	-	-
Mobile Application	+	-	+
Dashboard	+	+	-

3. PROPOSED MODEL ARCHITECTURE

The proposed model focus on children in schools or sport clubs and nurseries, and the second customer segment is people who travels and we can reach them throw tourism companies and car centers or individuals and old people in elderly home or hospitals and the down's syndrome persons in treatment centers, and do some operations like:

- Can scan the information by NFC technology or QR reader or write SSN by OCR.
- Ask for help request to ambulance or police.
- Make Band Aid to patients until ambulance arrived.
- Search by missing person face and can identify his information or get similar faces if not get it will save it and additional information as we can.

Figure 6A: Searching method using QR or SSN

Figure 6B: Searching method using NFC

3.1 proposed model Scenarios

There are four scenarios for developing and implementation the proposed solutions as shown in Figures (7A, 7B, 7C, 7D).the members of the proposed model Family , Other people , Ambulance centers ,and Police enters

For Family Members should

- Store family members' information.
- Use NFC tags in different shapes and store some information on it.

Other people

- Can request ambulance or police help from application.
- Can listen to Band Aid to help injured person until ambulance arrived.
- Can search any missing child or person his face.
- Can scan the NFC tag or QR to can contact his family.

Ambulance Center

- Receive help request and the injured information and accident location and finder information.
- Can follow the dashboard statistics to can make decision to improve solutions.

Police Center

- Receive help request and the injured information and accident location and finder information.
- Can follow the dashboard statistics to can make decision to improve solutions.

The architecture of the proposed model is shown in the following figures

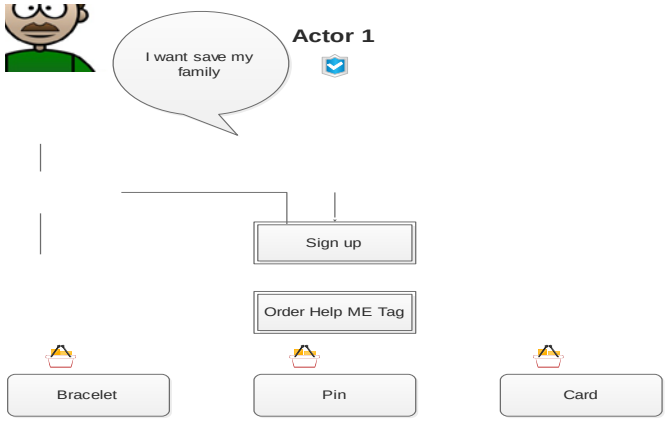


Figure 7A: First Scenario for proposed model

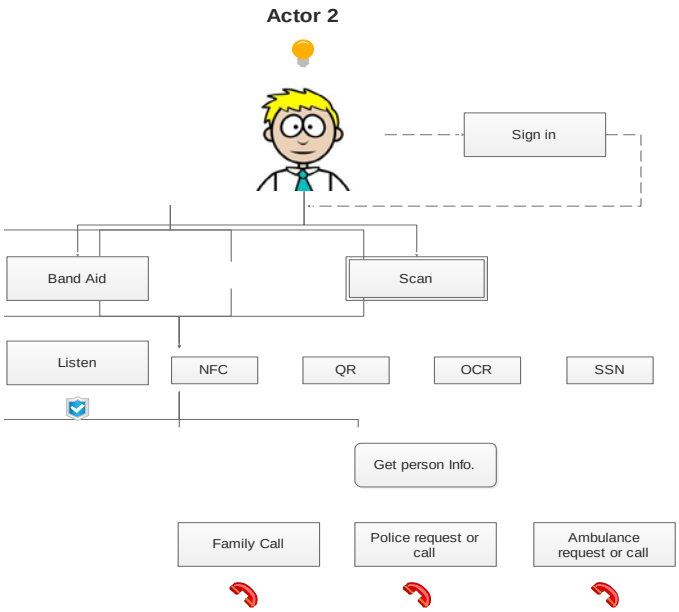


Figure 7B: second Scenario for proposed model

Figure 7C: Third Scenario for proposed model

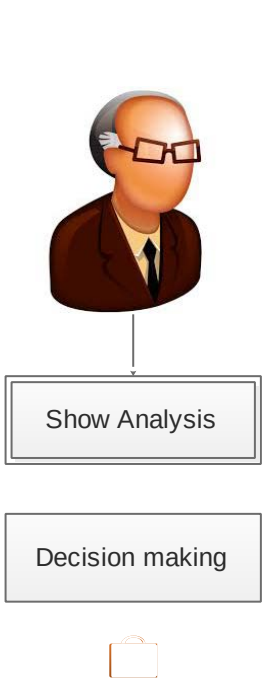


Figure 7D: Fourth Scenario for proposed model

3.2 the Architecture for the System development:

3.2.1 Barcode detection

- For Barcode detection, we use the Google Mobile APIs which provide bar code detection that read and decode a many of different bar code types, quickly, easily and locally.

- along with a Camera preview to detect both faces and bar codes in the same image.

- The Barcode type represents a single recognized barcode and its value. In the case of 1D barcode such as UPC codes, this will simply be the number that is encoded in the bar code.

- The other type of bar codes is 2D bar codes that contain structured data, such as QR codes.
- When using the proposed model, we can use mobile application to read barcodes in any orientation - they don't always need to be the straight on, and oriented upwards
- -- the value Format field is set to the detected value type, and the corresponding data field is set.
- all bar code parsing is done locally, so you don't need to do a server round trip to read the data from the code.
- In this type, we can use a Camera preview to detect both faces and bar codes in the same image.
-

The following figure show barcode detection algorithms for different types of barcodes.

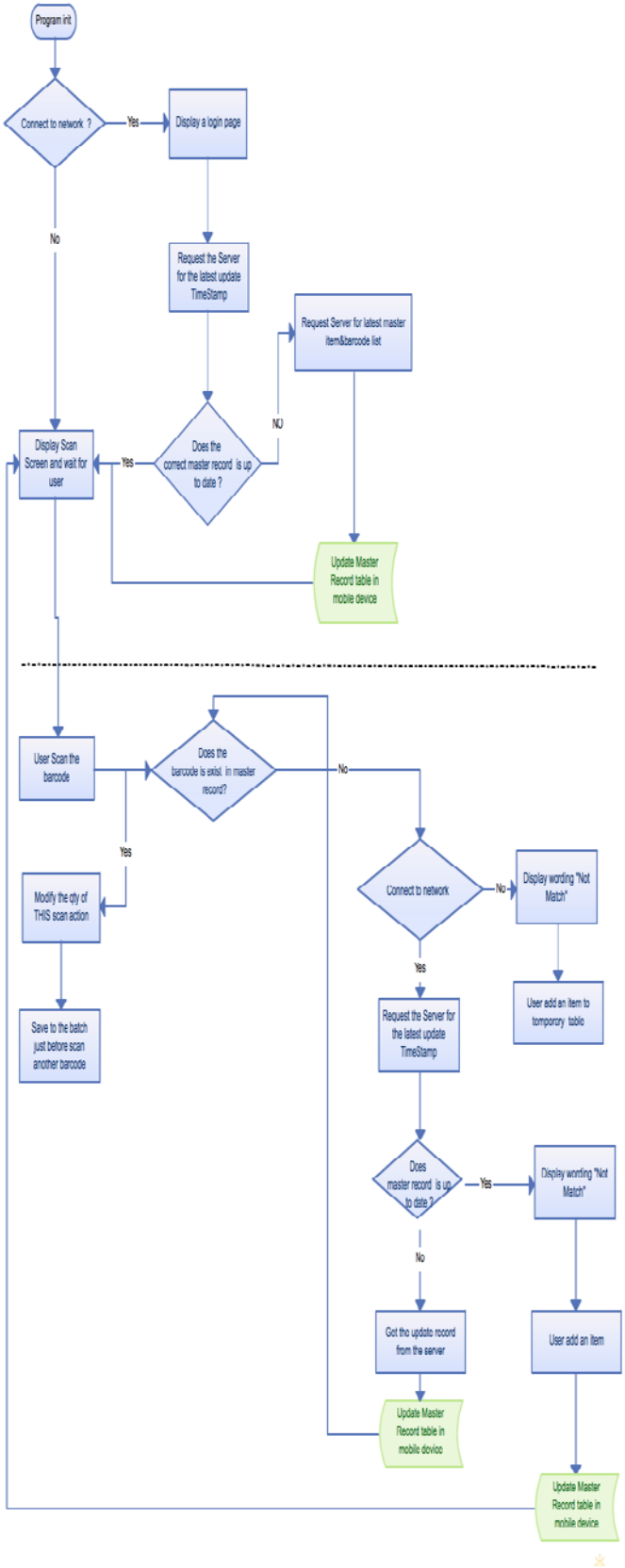


Figure 8: Barcode reading and detection algorithms

Barcode detection consists of the following steps

- Wiring up the Button
- Load the Image
- Setup the Barcode Detector
- Detect the Barcode
- Decode the Barcode

3.2.2 Optical Character Recognition (OCR)

- Optical Character Recognition (OCR) gives a computer the ability to read text that appears in an image, letting applications make sense of signs, articles, flyers, pages of text, menus, or any other place that text appears as part of an image. The proposed model uses google API that provide a powerful and reliable OCR capability that works with most Android devices and won't increase the size of your app.

- The following figure show OCR algorithms used in our application

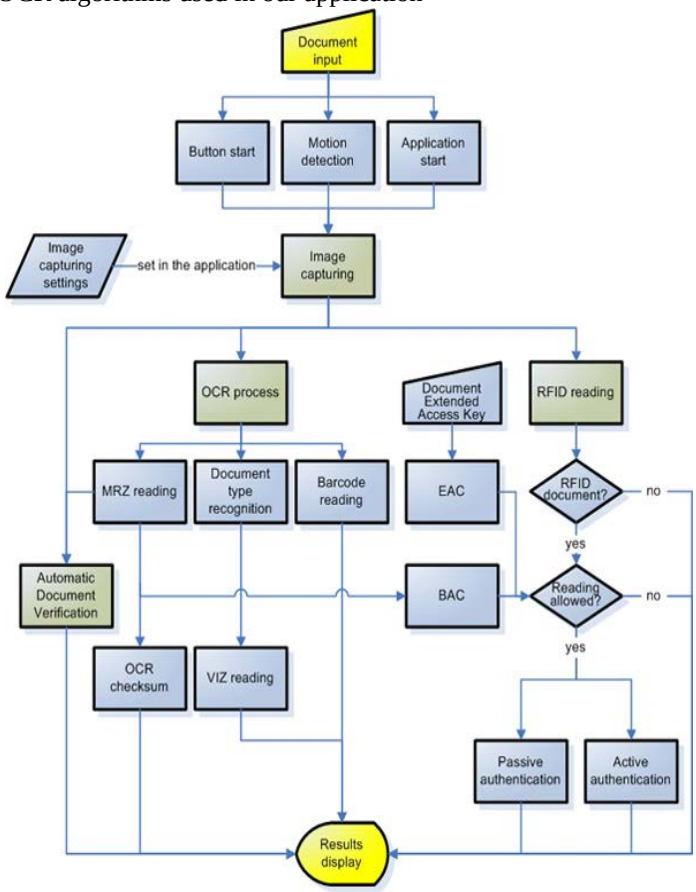


Figure 9: Optical Character Recognition (OCR) algorithm

3.2.4 NFC Technology

This section describes the basic NFC tasks you perform in Android. It explains how to send and receive NFC data in the form of NDEF messages and describes the Android framework APIs that support these features.

There are two major uses cases when working with NDEF data and Android:

- Reading NDEF data from an NFC tag
- Beaming NDEF messages from one device to another with android

How NFC Tags are Dispatched to Applications

When the tag dispatch system is done creating an intent that encapsulates the NFC tag and its identifying information, it sends the intent to an interested application that filters for the intent. If more than one application can handle the intent, the Activity Chooser is presented so the user can select the Activity. The tag dispatch system defines three intents, which are listed in order of highest to lowest priority:

We use three intents from google APIs .The first for start Activity when a tag that contains an NDEF payload is scanned and is of a recognized type (ACTION_NDEF_DISCOVERED). If no activities register to handle the ACTION_NDEF_DISCOVERED intent, the tag dispatch system tries to start an application with this intent

(ACTION_TECH_DISCOVERED). The third to started if no activities handle the ACTION_NDEF_DISCOVERED or ACTION_TECH_DISCOVERED intents (ACTION_TAG_DISCOVERED).

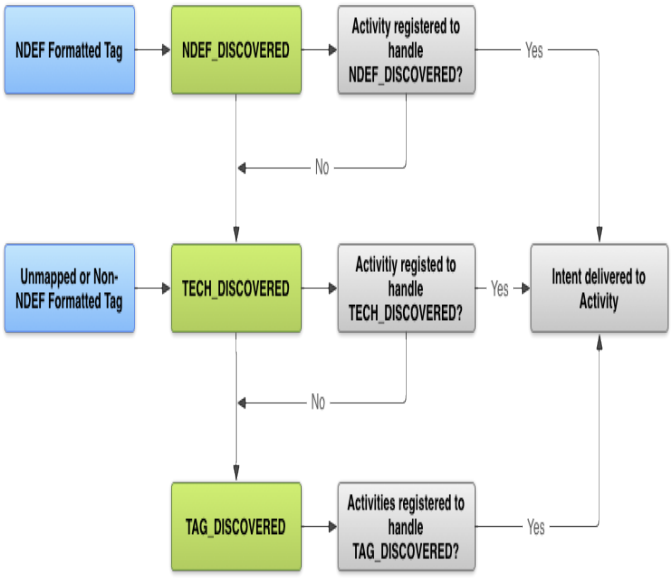


Figure 10. Tag Dispatch System

3.2.5 Data Encryption

For encrypted data on the NFC tag, we using Caesar Cipher
one of the simplest forms of encryption. It is a substitution cipher where each letter in the original message (called the plaintext) is replaced with a letter corresponding to a certain number of letters up or down in the alphabet.

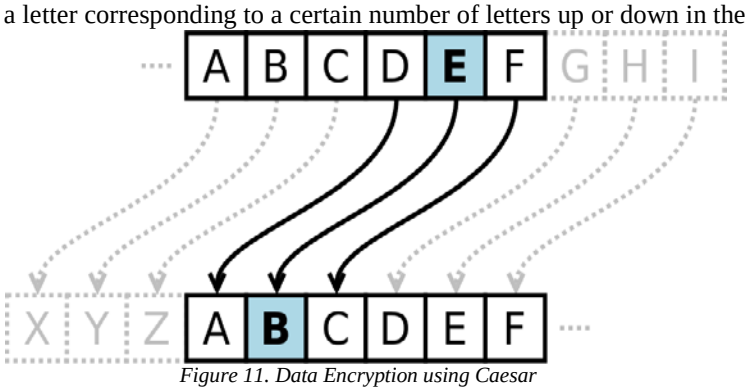


Figure 11. Data Encryption using Caesar

4. EXPERIMENTAL RESULTS

This idea of the proposed model briefly helps any person in missing or accident situations, our solution is consisting of database to store people information and we use azure as a cloud platform in our solution also mobile application to scan the NFC Tag to get person information to can contact his family or contact with police or ambulance.

4.1 Mobile application explanation:

The following is a detailed description of the mobile application:

Person who permit to enter the mobile application:

Home Screen:

- The first screen in the mobile application.
- Can listen to Band Aid.
- Can get scan feature to get peoples information.

Figure 12. Mobile Application Home Screen

Scan Screen:

- Can get the person information by alternative ways such as (NFC tag – QR – OCR – Phone Keyboard)

Figure 13: Searching Results by Scanning using NFC Tag

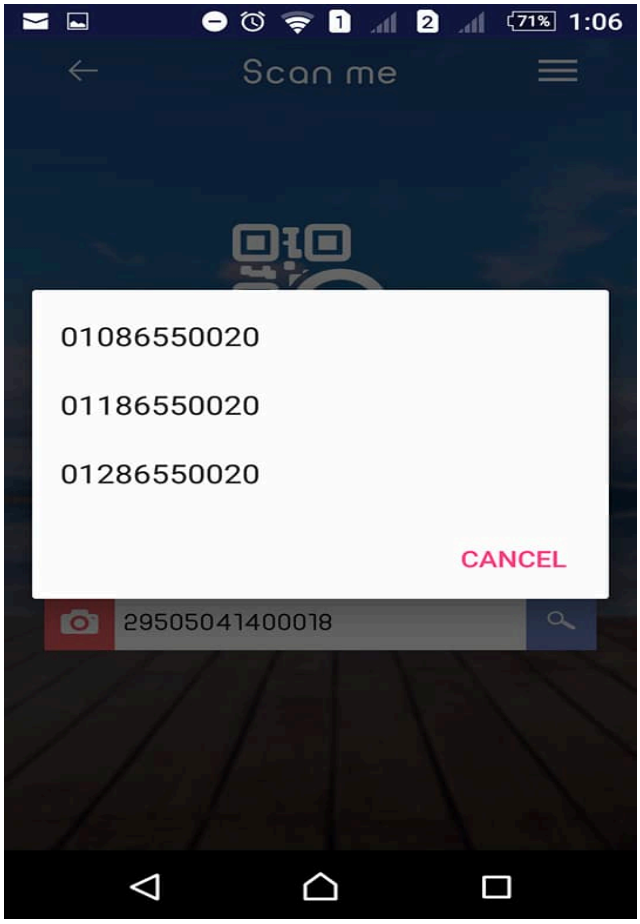


Figure 14: Searching Results by Scanning using SSN and QR

Figure 15: NFC Data Writing

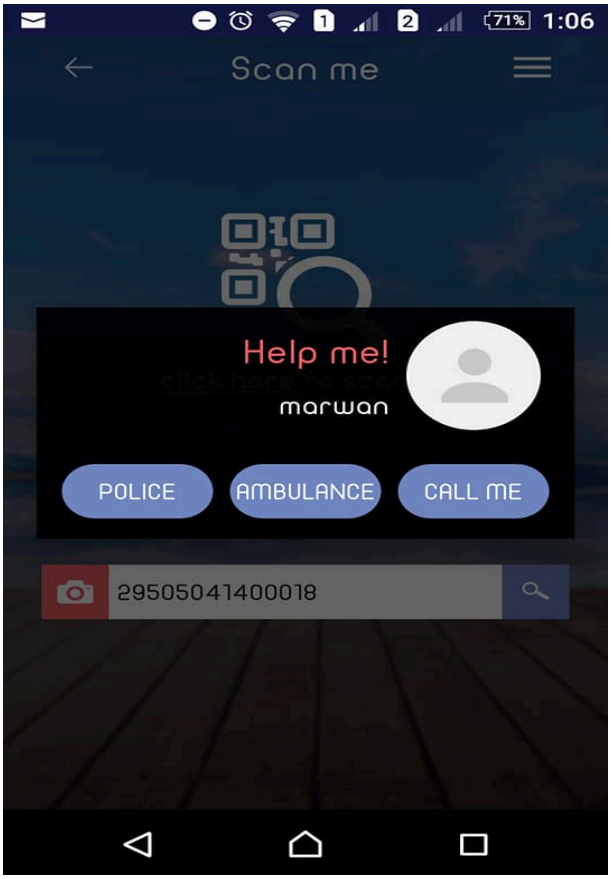
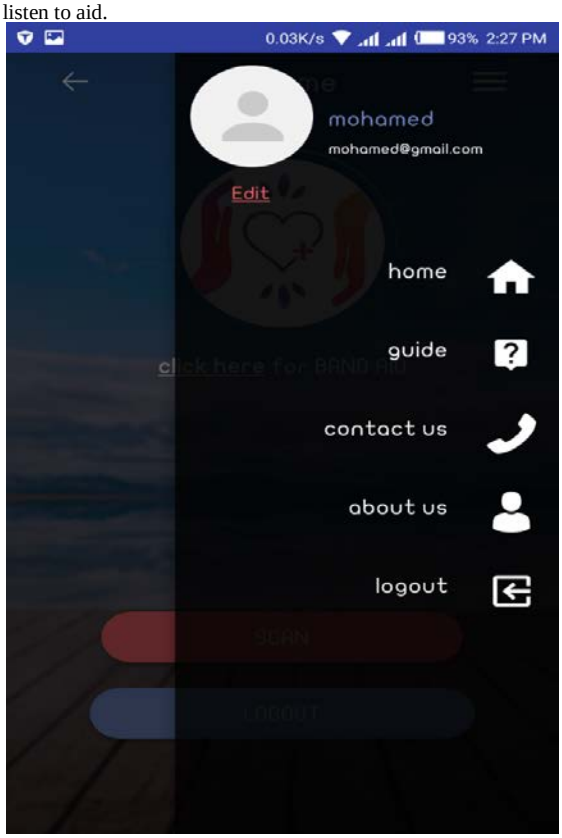


Figure 16: Call the family of missing people

Band Aid Screen:

- Choose the type of injury and listen to aid.



5. CONCLUSIONS

This paper proposes a new smart life saver system for alzheimer patient, down syndromes, and child missing using IoT. our solution is consisting of database to store people information and we use azure as a cloud platform in our solution also mobile application to scan the NFC Tag to get person information to can contact his family or contact with police or ambulance. The proposed model search for missing people using different technology such as NFC tags, QR, SSN, and face recognition. Our systems ensure maximum security and ensure finding missing people through smart phones that provides the different searching methods.

6. REFERENCES

[1] Diaa Salama Abdul.Elminaam, Hatem Mohamed Abdul kader, Mohie Mohamed Hadhoud,M S Elsayed , "Increase the Performance of Mobile Smartphones using Partition and Migration of Mobile Applications to Cloud Computing". International Journal of Electronics and Information Engineering (IJEIE), Vol.1, No.1, PP.34-44, Sept. 2014

[2] Diaa Salama Abdul.Elminaam, Hatem Mohamed Abdul kader, Mohie Mohamed Hadhoud,M S Elsayed , "Mobile Cloud Computing Framework for Elastic Partitioned/ Modularized Applications Mobility ". International Journal of Electronics and Information Engineering (IJEIE), Vol.1, No.2, PP.1-12, Dec. 2014

[3] Diaa Salama Abdul.Elminaam, Ahmed A. Toony, Mustafa Abdul Salam , "Prediction of Host Load in Cloud Computing Based on Quantum Evolutionary Algorithm and Kalman Filter with ANFIS ". IJCSNS International Journal of Computer Science and Network Security, VOL.17 No.9 pp: 59- 64, Septemebr 2017.(ISSN: 1738-7906)

[4] Diaa Salama Abdul.Elminaam, Hatem Mohamed Abdul kader, Mohie Mohamed Hadhoud,M S Elsayed , "Increase the Performance of Mobile Smartphones using Partition and Migration of Mobile Applications to Cloud Computing". International Journal of Technology Enhancements and Emerging Engineering Research (IJTEEE), Volume 2 - Issue 5, May 2014 Edition - ISSN 2347-4289

[5] Diaa Salama Abdul.Elminaam, Hatem Mohamed Abdul kader, Mohie Mohamed Hadhoud,M S Elsayed , "I Preserve Available Sensing and Interactivity Capabilities of Mobile Devices". International Journal of Technology Enhancements and Emerging Engineering Research (IJTEEE), Volume 2 - Issue 5, May 2014 Edition - ISSN 2347-4289

[6] Winter, J. (2016). "Algorithmic discrimination: Big data analytics and the future of the Internet". In J.S. Winter & R. Ono (Eds.), The future Internet: Alternative visions. New York: Springer. volume 17, pp 125-140

[7] Qin, Y., Sheng, Q., Falkner, N., Dustdar, S., Wang, H., & Vasilakos, A. (2016). "When things matter: A survey on data-centric internet of things". Journal of Network and Computer Applications, (64), Pp. 134-153.

[8] Makhoul, A., Guyeux, C., Hakem, M., & Bahi, J. (2016). "Using an epidemiological Approach to Maximize Data Survival in the Internet of Things". ACM Transactions on Internet Technology(TOIT), 16 (1), Pp. 5-15.

[10] Yachir, A., Amirat, Y., Chibani, A., & Badache, N. (2016). "Event-Aware Framework for Dynamic Services Discovery and Selection in the Context of Ambient Intelligence and Internet of Things". IEEE Transaction on Automation Science and Engineering, 13 (1), Pp. 85-102.

[11] Shelby, Z., & Bormann, C. (2009). The wireless embedded Internet. New York: John Wiley & Sons Ltd.

[12] Perera, C., Liu, C., Jayawardena, & S., Chen, M. (2014). "A Survey on Internet of Things From Industrial Market Perspective". IEEE Access, vol. 2, Pp. 1660-1679.

[13] Lee, S., Tewolde, G., & Kwon, J. (2014). "Design and implementation of vehicle tracking system using GPS/GSM/GPRS technology and smartphone application". 2014 IEEE World Forum on Internet of Things (WF-IoT), Pp. 353-358.

[14] Raji, P., and Ashok, S. (2015). "Development of GSM and GPS based Cost Effective Telematics Module". International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 4 (5), Pp. 3935-3943.

[15] Kolaskar, M., Chalke, A., Borkar, M., Naik, K., Lande, B., and Suralkar, V. (2016). "Real Time and Offline GPS Tracker Using Arduino". Imperial Journal of Interdisciplinary Research, 2 (5), Pp. 92-94.

[16] Saxena, C., Phardwaj, P., Sharma, A., Rastogi, A., & Arya, B. (2015). "Real Time Vehicle Ceasing and Tracking Using GMS and GPS Technology". International Journal of Scientific Research and Management Studies, 2 (1), Pp. 72-77.

[17] Kalaiarasi, A., Raviram, P., Prabakaran, P., Shanthosh, K., & Dheeraj, B. (2014). "Vehicle Scrutinizing using GPS & GSM Technologies Implemented with Ardunio controller". International Journal of Innovative Research in Science, Engineering and Technology, 3 (2), Pp. 189-193.

[18] Chaudhari, A., Bohra, S., Karma, H., & Dhupadle, A. (2015) "GPS/GSM Enabled Person Tracking System". International Journal of Inn vative Research in Science, Engineering and Technology, 4 (3), Pp. 981-986.

[19] Rajaram, G., Machindra, G., Ramdas, J., & Yashwant, P. (2016). "Implementation of Child Tracking System Using Mobile Terminals". Imperial Journal of Interdisciplinary Research, 2 (4), Pp. 354-357.

[20] Al-Khedher, A. (2011). "Hybrid GPS-GSM Localization of Automobile Tracking System". International Journal of Computer Science And Information Technology (IJCSIT), 3(6), Pp.75–85.

[21] Alnizari, A. (2011) A real-time tracking system using RFID in Mecca. Master's Thesis. Massey University: New Zealand.
[22] Jain, A., Mudgil, P., Dabla, R., & Satapathy, K. (2014). "Android Based Tracking Application– DOPE HUNT", International Journal of Soft Computing and Engineering (IJSCE), 4 (14), Pp. 38-41.