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Design of Residental Safety System Using E-KTP

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Abstract

Residential security applications by using computer technology has grown rapidly. Motion detectors, contacts on doors and windows, sirens, and a leading provider of security services for housing security management has been widely applied in electronic-based. A simple and practical use of residential security application could improve the performance efficiently and savings the cost. e-KTP card as RFID-based is used for single sign-on access on residential security areas. A reader-tag generates passively electromagnetic waves which inductances the carrier frequency of 13, 56 Mhz which produce output power around 30 dbm is assumed. In order to improved the security performance, e-KTP is integrated with software system using delphi 8.0. Theoritical results shows that a reading tag capability has measures the distance is λ = 0 cm to 2 cm has been achieved. Moreover, e-KTP is sufficient for actively sensed by reader tag. At the λ = 1 cm (0.01 m), P_t = 1 watt, therefore the received power is 0.0011 watt (0.4 dbm). This power has induced by reader tag to generate power in e-KTP. The results shows that the more distances are longer, the greater power is needed to induces e-KTP by reader tag.

Keywords: *e-KTP, RFID reader, Residential Security Management*

1. Introduction

The economic conditions Indonesia's mostly very attentive to cause high levels of crime, in order to meet the necessities of life, people do not hesitate to again commit a crime, such as theft and robbery in the housing. Residential security applications has been developed using computer technology. A security systems usually consist of a motion detector, the contacts on doors and windows, sirens, and the company that monitor a home during the passage of the system.

RFID is based on radio waves is used to identify an object [1]. RFID is a system which able to transmit and receive the data by generates radio waves, which consists of two parts: (tag) or the transponder and reader [1]. Indonesia Electronic identity card (e-KTP) is based on RFID tag. A chip that stores the unique ID number has been attached on the card. One of the example utility is the safety gate, this safety device utilizing the e-KTP card to open the door using 13.56 MHz.

2. Related Study

2.1. RFID

RFID is a technology which able to transmit and delivery the data electronically. The functions are identify, tracking and information stored in the tag using radio waves. RFID uses radio frequency that reading the information from a tag or transmitter-responder (transponder) [2].

Flexible and autonomous operation has been showed by RFID technology. RFID is provided in the form of devices that can be read only (Read Only) or readable and writable (Read / Write), which operates does not require direct contact or path, and provide a high level of data integrity.

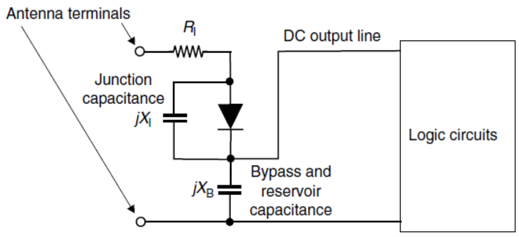

Figure 1. A simplified schematic IC RFID label [3]

From Figure 1 above, according to [3], X_l represents reactance of the capacitance diode, X_B is the reactance of the capacitor is also a bypass RF and R_1 as a loss in power is brought into and out of capacitance diode junction. Moreover, according to [3], RFID chip impedance input of is defined by the capacitance junction of the rectifier diode. Due to the sensitivity of the junction capacitance with voltage biasing, the input impedance is a complex function among the operating frequency and input power to the chip through the antenna.

In general, the chip impedance, Z_c is measured at the operating threshold, thus the antenna impedance conjugate is matched at the lowest power levels where the chips will operates successfully. To ensures that the chip receives a number of power when the tag position is furthest from the power of RF wave [3]. As illustrated in Figure 1, the input impedance of the RFID chip in the threshold (threshold) operation (minimum input sensitivity) is capacitive. The input impedance of an RFID chip (IC) can be modeled as shown [3].

$$Z_c = R_{Series} + (\frac{1}{j\omega} C_{Series}) \qquad (1)$$

Where :
Z_c is the chip impedance
R_{Series} is a series resistance equivalent circuit of the chip input impedance.
C_{Series} is a series capacitance equivalent circuit of the chip input impedance

The analysis of power detection by tags process are limited, it is assumed that the system is satisfy designed so that the sensitivity of the RF receiver interrogator is not the limiting factor. In such a scenario, tag detection range theoretically with losses antenna can be calculated from equation Friis that is [3]:

$$P_r = P_t\, g_t g_r\, (\frac{\lambda}{4\pi r}) \qquad (2)$$

Where:
P_r : the available source power from the tag antenna (watts).
Pt : the transmitted power (watts).
λ : the wavelength (meters).
r : the distance between transmit and the receive antennas (meters).
g_r : the gain of the transmitting antenna (watts).
g_t : the gain of the receiving antenna (watts).

Therefore, a range of the tag is evaluated as given in the equation (2) where the radiated power and power gain antenna replaced with EIRP and provided the necessary resources at the position tag antenna is P_r (tag position) [3]:

$$r \le \frac{\lambda}{4\pi}\sqrt{\frac{EIRP_{reader} g_{tag}}{P_{r(tag)}}} \qquad (3)$$

Where *r* is the distance between transmit and receive antennas (meters), for a possible maximum read range when it was sufficient to energize the tag. Equation (3) is useful if the expression may be obtained for P_r (tag). It requires proper consideration in the case of a passive tag technology.

Thus, a minimal amount of operating power requires the tag is knowned, and it is assumed that the tag receives it's power. The efficiency of the power transfer from the antenna to the circuit tag before modulation. It is the ratio of power in the presence of modulation with the power source provided from the tag antenna [3].

2.2. RFID Systems Model

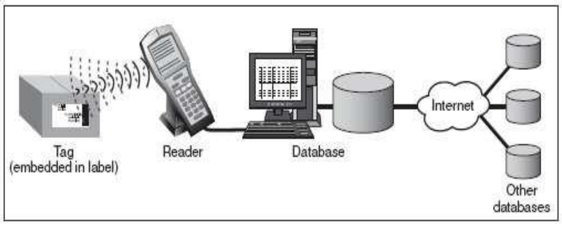

Figure 2. Image Component In RFID applications [2]

In Figure 2 RFID system comprises of four components, the RFID tag (transponder), a reader, antenna and interface software [3]. RFID tag (transponder) could storage any data information form such as unique ID number and. At the circuit, integrated antenna is installed which is transmit the data thorugh radio waves emmited by the reader. The RFID reader is a device that compatible with RFID transponder. The antenna is provided in both of tags and reader. To communicates between the RFID and system is interface software which is used to proceed a reading and transmit data or processing the incoming data become the unique password.

2.3. e-KTP

e-KTP card or electronics ID card is the residence documents that provides information data such as Population Identification Number (NIK). The NIK is a single identity of resident and is valid for life [4]. This number is used as the basis for issuance of Passport, Driving License (SIM), of Tax payer Identification Number (NPWP), the Insurance Policy, Certificate on Land Rights and the issuance of others identity documents [4].

The population information included in the e-ID card is shown in the following layout is based on RFID [5]:

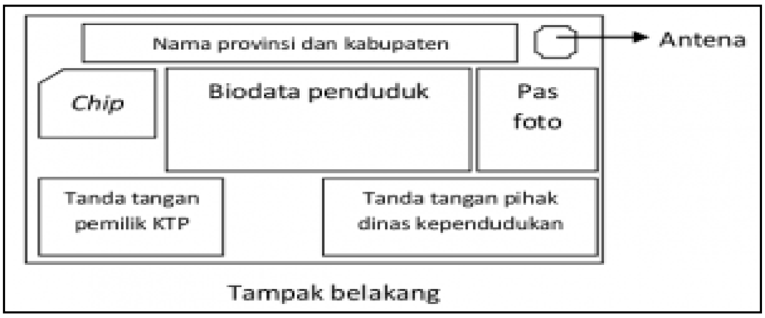

Figure 3. Structure of e-KTP [5]

Various computing processes is performed by using the embedded chip of e-KTP. Moreover, the e-KTP is performed in a variety of complex algorithms and security protocols [6].

Figure 4. Chip In the e-KTP [6]

3. Research Method

The RFID-based development of security systems in residential has been develop. A useful safety device using e-KTP has been develop by researchers[3]. However, integrated safety residential security based on e-KTP is less attention. In this works, a residential safety system is developed. The model are comprises into three layered model to support the dealing with the convergence systems. The first layer is hardware installment systems, the second layer is database design systems and the third layer is the software systems.

3.1. Hardware

e-KTP is designed based on RFID features system design as admission of residential safety systems, the following hardware needs are.

USB Reader RFID 13.56 MHz operating frequency. A function is received RF signals (e-KTP) that induced by RFID reader to the e-KTP and stored into the database.

Features of the USB RFID reader includes [2]:

1. Support for global EPC Gen 2 (ISO 18000-6C) with Anti- collision and DRM linearly polarized antenna with a peak gain 1 dBi 860-960 MHz.
2. Powered by a USB connection to a notebook or desktop PC.
3. Support for the full range of carrier frequencies 860-960 MHz UHF RFID.
4. Tag Read Rate up to 200 tags /sec.
5. Tag Read Distance Up to 3 feet (0.91 m).
6. Dimensions: Length 97 mm, Width 61 mm, Height 25 mm

3.2. Software

The software is designed to adequates the RFID characterstic which are able to read and processing the reader results. Delphi 8.0 is used to develop the system which is compatible with the e-KTP. To support the number of residental, ADO database system is integrated with Delphi 8.0. Furthermore, a tags process is running, a software is proceed the unique ID of residential based on the ADO database registered in data base.the dtable.

A confirmation information is generated by the system whether the gues is pass through the residential or not. The following flow chart model is descripted the works flow model of a secure system for residential using e-KTP as shown in figure 5.

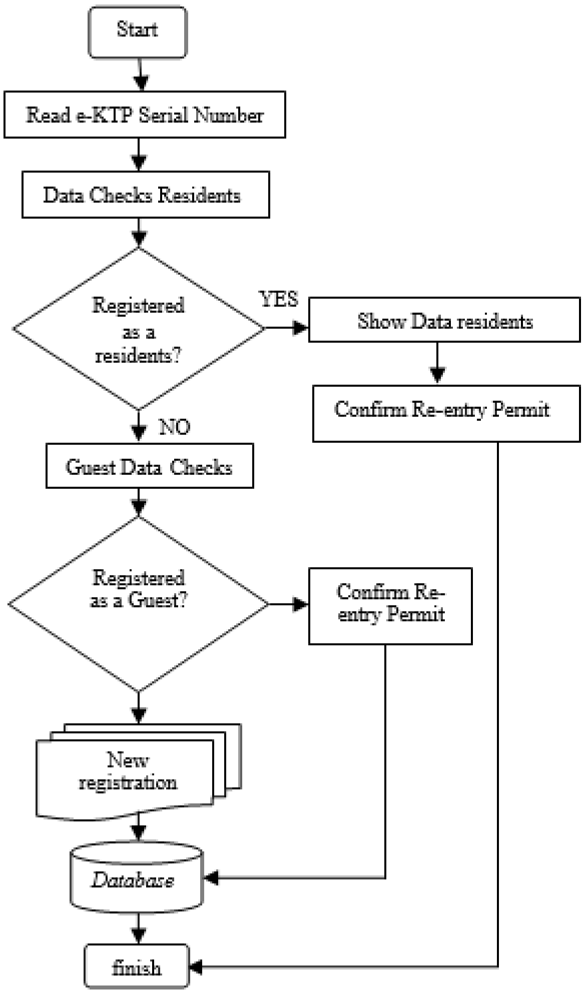

Figure 5. RFID System Flow -based e-KTP card

Figure 5 shows the system flow as follows :

1. Any person who enter the residential will pass through a security guard.
2. The security guard checked e-KTP by touching the Reader. Once information is a fixed or matched, the system announced of a pop up news whether the gues is local citizen or not.
3. If not a citizen, the system then directly point for new registration as as a guest. After data is recorded then the person is allowed to enter into the residential.

4. Results and Analysis

The studies are conducted into two approach model analysis. The first method based on the experimentation of the RFID and theoritical analysis. The black box testing is attached for software testing. This testing is conducted where the software is properly functional and the connection interface is worked with. Both method are comparing to achieve the performance metric in RFID environment. The second is a black box testing for software system.

4.1. Distance USB RFID Reader Module Testing

The ID number is detected by the reader, the measurement method is placed the e-KTP near by of the reader. A closed testy is done in order to investigaty the capability of e-KTP received power from the reader. The distance are range is from 0 cm to 2.4 cm, the touch method is used which test the ready capability by reader. The testiny is aimed to measures the distance of e-KTP capabily by is it range of reading. The test results is shown in Table 1.

Table 1. The e-KTP distance testing by RFID Reader

No	Type ID Tag	Distance (cm)	Remark
1	e-KTP	0	read
2		0.2	read
3		0.4	read
4		0.6	read
5		0.8	read
6		1	read
7		1.2	read
8		1.4	read
9		1.6	read
10		1.8	read
11		2	read
12		2.2	unread
13		2.4	unread

Table 1 e-KTP distance testing by RFID Reader. It is described that the detection of e-KTP start at the distance of 0 cm to 2.4 cm. At a distance of λ = 0 cm to 2 cm e-KTP perfectly detected, at this stage transmitted is assumed power in transmitter (Pt) = 1 watt (30 dBm) assumed, thus the received power (Pr) is 0.016 watts (12 dBm). It means that by 0.080 watts, a RFID reader emits radio's wave and induce e-KTP. The function of emitted radio wave is provide a passive power that generat the ID numbers data in the e-KTP. Usually the detection ranges indicated by the size of the antenna, the antenna has a good quality, the range could be further coveraged.

In order to measured the capability of detection speed the distance are varies by 0 cm to 2 cm. For f = 13.56 MHz and period T (1/f) = 73.75 nanosecond (ns) or 73, 75 x 10^{-9} ns the velocity of detection is obtained by :

$$v = \frac{\lambda}{T}$$

Where v is the velocity of sound waves m/s; f is the frequency (Hertz); λ is the wavelength (m); and T is the period (seconds).

Table 2. Testing Free e-KTP with RFID Reader.

No	Distance (λ)	Period (T) = 1/f	Speed (V) = $\frac{\lambda}{T}$
1	0.2 cm	73.75 x 10^{-9} s	0.03 x 10^{6} m/s
2	0.4 cm	73.75 x 10^{-9} s	0.05 x 10^{6} m/s
3	0.6 cm	73.75 x 10^{-9} s	0.08 x 10^{6} m/s
4	0.8 cm	73.75 x 10^{-9} s	0.11 x 10^{6} m/s
5	1 cm	73.75 x 10^{-9} s	0.14 x 10^{6} m/s
6	1.2 cm	73.75 x 10^{-9} s	0.16 x 10^{6} m/s
7	1.4 cm	73.75 x 10^{-9} s	0.19 x 10^{6} m/s
8	1.6 cm	73.75 x 10^{-9} s	0.22 x 10^{6} m/s
9	1.8 cm	73.75 x 10^{-9} s	0.24 x 10^{6} m/s
10	2 cm	73.75 x 10^{-9} s	0.27 x 10^{6} m/s

The results shows that the distance measurement is obtained by nano-scale of T in second, it means that with a frequency of 13.56 MHz, e-KTP is very adequate for the passive category tag of reading by the reader. More than 2 cm, e-KTP is unattached. These are two probabity that e-KTP doesn't attached it's ID and data. First the power generation is not enough to induced e-KTP more than 2 cm distances or secondly is e-KTP antenna is not fulfilled or sufficient to received induction power from the reader, due to less quality of lopper materials.

To calculate the wavelength theoritycally is known that *c* is the speed of light in vacuum 3 x 10^8 m/s and *f* is the frequency of 13.56 MHz RFID.

$$\lambda = \frac{c}{f}$$

$$\lambda = \frac{300000000}{13560000} = 22.12\ m$$

22.12 m is theoritycally calculation of distance. The results drived from the formula: the speed of light in vacuum (c) divided by frequency (f). A differences of real mensurements and theoritycally impacted by e-KTP card. However, the experiment shows the real capability of e-KTP chip. Antena factor esspecially on junction capacitance has influence the inductance capability of e-KTP. This juction has decreased the capability of sensitivity. Equation (1) has show the relation ship of input impedance that depend on operating frequency ($\frac{c}{jw}$ c $_{series}$) and series resistance (R1). By the experiment proces, the RFID types is knowned as passive RFID which does not requires large power.

The maximum distance that e-KTP is detected is 2.4 cm only. At > 2.4 cm is not detected. At this point a reader need a greater power to generate e-KTP data, a the distance is influenced the detection capabity of e-KTP by the reader. Equation 2 is used as referred received power meansurement by e-KTP. In this stage λ (lamda) is assumed as the distance of wave travelled. The distance are range from 1 cm to 1 meter. The radiated power is assumed as P_t = 1 watt[7]. The transmission gain (g_t) is 1 and the receiver gain is (g_r) = 1.

Table 3 shows, the measurement of received power (pr) by e-KTP.

Table 3. Measurement of Power Supply e-KTP with the RFID Reader [7]

No	λ (m)	r (m)	Pt (watt)	Pr (watt)
1	0.01	1	1	0.0011
2	0.05	1	1	0.004
3	0.10	1	1	0.008
4	0.15	1	1	0.012
5	0.20	1	1	0.016
6	0.25	1	1	0.020
7	0.30	1	1	0.024
8	0.35	1	1	0.028
9	0.40	1	1	0.032
10	0.45	1	1	0.036
11	0.50	1	1	0.040
12	0.55	1	1	0.044
13	0.60	1	1	0.048
14	0.65	1	1	0.052
15	0.70	1	1	0.056
16	0.75	1	1	0.060

17	0.80	1	1	0.064
18	0.85	1	1	0.068
19	0.90	1	1	0.072
20	0.95	1	1	0.076
21	1	1	1	0.080

It's clearly shown that the distance of $\lambda = 1$ cm (0.01 m) the received power is point to 0.0011 watt. e-KTP will received induced power by 0.0011 watt from the reader tag. Moreover, $\lambda = 1$ m, the received power is 0.080 watt (19 dbm). The longer distance e-KTP and reader will requires large power to induces e-KTP**.**

3.2. Software Testing

The aimed is to investigated the functional of e-KTP by given speed assumption.

Table 4. Software testing using speed of 0.01 second.

Speed e-KTP	Distance e-KTP with Reader	Reader	Software
(assumption 0.01 ms) speed (v)	0 cm	read	display
	0.5 cm	unread	undisplayeed
	1.5 cm	unread	undisplay
	2.0 cm	unread	undisplay

Table 5. Testing Software testing using with speed of 1 second.

Speed e-KTP	Distance e-KTP with Reader	Reader	Software
(assumption 1 second) speed (v)	0 cm	read	displayed
	0.5 cm	unread	displayed
	1.5 cm	unread	displayed
	2.0 cm	unread	displayed

Table 4 and 5 shows the exprimental of speed capability by assumed of speeds 0.01 second and 1 second. The distance varied from 0 cm to 2 cm. On the speeds is 0.01 second and the distance is 0.5 cm, e-KTP does not detected by the reader. However on the speeds of 1 second and thes distance is 0.5 cm, e-KTP detected as well. Bassed on the measuement and software testing, software is works well whether e-KTP is detected or not by displayed the information results. Moreover, a software is well communicated as well as with the hardware.

The speeds is affected by the frequency period of the wave lenght (λ). Further more, e-KTP requires a time is proceed. Inductane of power from the reader to detected is as well.

5. Conclusion

The residential security systems has been develop and presented. The results shows that e-KTP is performed by integrating with software system. The experimental analysis has show that e-KTP is passively RFID. The maximum distance tags is less than 2 cm. As compared to the theoritical, the distance is decreased significantly. However, integration of e-KTP with the system is performed and works well based on the information from e-KTP. Moreover, the tags reading should closed to the RFID reader.

For the future research the monitoring and secuirty development systems based on e-KTP is performed using android systems. A internet networking is driven to conduct residential security system efficiently.

In the future, e-KTP requires any types of active RFID or NFC with larger storage capacity so that used to share applications such as medical records, e-banking, and others.

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