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Table of contents

Volume 879

2020

3rd International Conference on Informatics, Engineering, Science, and Technology (INCITEST 2020) 11 June 2020, Bandung, Indonesia

Accepted papers received: 11 June 2020

Published online: 05 August 2020

Open all abstracts

Preface

OPEN ACCESS   011001

Preface

+ Open abstract   View article   PDF

OPEN ACCESS   011002

List of Committees of INCITEST 2020

+ Open abstract   View article   PDF

OPEN ACCESS   011003

Peer review statement

+ Open abstract   View article   PDF

Informatics and Information System

OPEN ACCESS   012001

Digital Wallet as a Transaction Media in The Community

T Handayani and A Novitasari

+ Open abstract   View article   PDF

OPEN ACCESS   012002

Smart City and Its Application

I Prayoga and R M Ramadhan

+ Open abstract   View article   PDF

OPEN ACCESS   012003

Smart Campus with A Learning Management System

E S Soegoto and M F Rinaldy

+ Open abstract   View article   PDF

OPEN ACCESS   012004

The Influence of Information Technology on Public Transportation

T Rohmawati and I Kartiwan

+ Open abstract   View article   PDF

OPEN ACCESS   012005

Android Based Livestock Sales Application Information System

T Rohmawati and F Ramadhani

+ Open abstract   View article   PDF

OPEN ACCESS   012006

Artificial Intelligence and New Level of Fake News

S Nazar and M R Bustam

+ Open abstract   View article   PDF

OPEN ACCESS   012007

Design of Web-based Online Sales Information System

H D Yulianto and R Fauzi

+ Open abstract   View article   PDF

OPEN ACCESS   012008

Information Technology on Employee's Daily Evaluation System Software

D W Firdaus and R Lie

+ Open abstract   View article   PDF

OPEN ACCESS   012009

Web Service for Academic Information Systems

A R Kurniawan and L Warlina

+ Open abstract   View article   PDF

OPEN ACCESS   012010

Design of Information System Vehicle Rental Based Web

B Kurniawan, S Alviana and A M B Prasetyo

+ Open abstract   View article   PDF

OPEN ACCESS   012011

Utilization of Technology for Early Warning of Natural Disasters in Indonesia

W H Pratama and I D Sumitra

+ Open abstract   View article   PDF

OPEN ACCESS   012012

Technology of Health Services in Industrial Revolution 4.0 Era

V V Vauzia and I D Sumitra

+ Open abstract   View article   PDF

OPEN ACCESS   012013

The Effect of Using a Digital Wallet for Small Business

S M Putri and I D Sumitra

+ Open abstract   View article   PDF

OPEN ACCESS   012014

Application Information System Smart Parking Based on Smartphone

R Wahdiniwaty and A Nugraha

+ Open abstract   View article   PDF

OPEN ACCESS   012015

Web-Based Information Systems: Developing a Design Theory

I B S Nusa and F M Faisal

+ Open abstract   View article   PDF

OPEN ACCESS   012016

Design of Application for Students Attendance Checking in Islamic Boarding School

M D Aulia and R Hendriawan

+ Open abstract   View article   PDF

OPEN ACCESS   012017

Comparative Analysis of 4G Network Internet Data Connectivity Based on Quality of Service (QoS) Method (Case Study West Bandung Regency Tourism Area)

T Ernawati and B D Pratama

+ Open abstract   View article   PDF

OPEN ACCESS   012018

Study of Risk Assessment and Business Continuity Management of Analog to Digital Archiving Process in order to Guarantee Reliable System

Yeffry Handoko Putra and Rahma Wahdiniwaty

+ Open abstract   View article   PDF

OPEN ACCESS   012019

Model of Autonomous Unmanned On-Road and Aerial Vehicle Carriers For Precision Agricultural Transport 4.0 : A Literature Review

I Afrianto, A Khumaidi and Adriyendi

+ Open abstract   View article   PDF

OPEN ACCESS   012020

Location Search Application for Refuelling Stations on Android Based Mobile Devices

S Nurhayati, N Milal and A P Sujana

+ Open abstract   View article   PDF

OPEN ACCESS   012021

Web-Based Honorary Teacher Payroll Information System

N Hasti, D Dekiki, I Gustiana, W Wahyuni and T Hartono

+ Open abstract   View article   PDF

OPEN ACCESS   012022

Raspberry Pi-Based Solar System Learning Media

M F Wicaksono, Syahrul, M D Rahmatya and M A F Rahman

+ Open abstract   View article   PDF

OPEN ACCESS   012023

Design of Reservation Information System

M D Rahmatya, M F Wicaksono, D P Sari and M N Mubarok

+ Open abstract   View article   PDF

OPEN ACCESS   012024

Application of Web-Based in Product Distribution using Unified Modelling Language

L Melian and F N Fauzan

+ Open abstract   View article   PDF

OPEN ACCESS   012025

Information System of Roof Tiles Production and Distribution

R F Syafariani, E N Hayati and F A Muttasir

+ Open abstract   View article   PDF

OPEN ACCESS   012026

Implementation of the Failure Mode and Effects Analysis (FMEA) Method to Determine Project Risk Priority

S Atin and R Lubis

+ Open abstract   View article   PDF

OPEN ACCESS   012027

Design Securing Online Payment Transactions Using Stegblock Through Network Layers

E Ardhianto, A Trisetyarso, W Suparta, B S Abbas and C H Kang

+ Open abstract   View article   PDF

OPEN ACCESS   012028

Protecting Data By Socket Programming Steganography

WT Handoko, E Ardhianto, K Hadiono and FA Sutanto

+ Open abstract   View article   PDF

OPEN ACCESS   012029

Integration of TOGAF 9.1 ADM in Enterprise Architecture Smart City Design in the Tourism Domain with ISO 27001

P Subakti and Y H Putra

+ Open abstract   View article   PDF

OPEN ACCESS   012030

Acquisition, Modeling, and Evaluating Method of Driving Behavior Based on OBD-II: A Literature Survey

Galih Hermawan and Emir Husni

+ Open abstract   View article   PDF

OPEN ACCESS   012031

Web Application Vulnerability Detection Using Taint Analysis and Black-box Testing

Heribertus Yulianton, Agung Trisetyarso, Wayan Suparta, Bahtiar Saleh Abbas and Chul Ho Kang

+ Open abstract   View article   PDF

OPEN ACCESS   012032

Sales Promotion System Design with Customer Relationship Management approach at Hotel

G T Mardiani and T Faturrahman

+ Open abstract   View article   PDF

OPEN ACCESS   012033

Development of Expert System for Dental and Oral Diseases Diagnose in Certainty Condition

R Sidik, M A Fadlurrahman and M B Winanti

+ Open abstract   View article   PDF

OPEN ACCESS   012034

Design of Recyclable Waste Mapping Information System for Waste Pickers

Leonardi Paris Hasugian, Satria Indra Praja Persada and Triana Mugia Rahayu

+ Open abstract   View article   PDF

OPEN ACCESS   012035

The Waqf Cemetery Information System

R Komalasari

+ Open abstract   View article   PDF

OPEN ACCESS   012036

Private Cloud Development in West Java Cooperative and Entrepreneurship Education and Training Center

A Setiyadi and E B Setiawan

+ Open abstract   View article   PDF

OPEN ACCESS   012037

Spatial Information System Development in Bintan Regency

J C Wibawa, M E Utomo and M R Fachrizal

+ Open abstract   View article   PDF

OPEN ACCESS   012038

Product Development Analysis using Quality Function Deployment

R Susanto and A D Andriana

+ Open abstract   View article   PDF

OPEN ACCESS   012039

The Application of Fuzzy Logic Method in the Debtors Eligibility Assessment System of Microfinance Institution

S L B Ginting, M R M Rizky, Y R Ginting and Sutono

+ Open abstract   View article   PDF

OPEN ACCESS   012040

Security Value Issues on eHealth Implementation in Indonesia

P K Sari, P W Handayani and A N Hidayanto

+ Open abstract   View article   PDF

OPEN ACCESS   012041

Innovation Development of Web-Based Dormitory Information System at Boarding School SMA Terpadu Krida Nusantara

Jafrudin and Yeffry Handoko Putra

+ Open abstract   View article   PDF

OPEN ACCESS   012042

Prototype of E-Document Application Based on Digital Signatures to Support Digital Document Authentication

I Afrianto, A Heryandi, A Finandhita and S Atin

+ Open abstract   View article   PDF

OPEN ACCESS   012043

Cyber Security in IoT communication (Internet of Things) on Smart Home

Herman Heriadi and Geraldi Catur Pamuji

+ Open abstract   View article   PDF

OPEN ACCESS   012044

Design of Furniture Production Monitoring Information System

R P Dhaniawaty, A P Fadillah and D Lubis

+ Open abstract   View article   PDF

OPEN ACCESS   012045

Benefit of Using Cloud Services in IT Infrastructure in the Capability, Strategy and Cost Efficiency Aspects: detikNetwork Case Study

R A Putra, G D Putra, N F Arifin, B Haryanto, M R Shihab and B Ranti

+ Open abstract   View article   PDF

OPEN ACCESS   012046

A Brief Look at Software Defined Network (SDN) Implementation: Gaining Benefits and Coping with the Challenges at a Telecommunication Company

M R Adrian, D H Kurniawan, A Faza, J Maulina and M R Shihab

+ Open abstract   View article   PDF

OPEN ACCESS   012047

Information System Security Analysis of XYZ Company Using COBIT 5 Framework and ISO 27001:2013

G G Prapenan and G C Pamuji

+ Open abstract   View article   PDF

OPEN ACCESS   012048

Raw Material Supplier Selection With Analytics Hierarchy Process (AHP) Method

H Irmayanti

+ Open abstract   View article   PDF

OPEN ACCESS   012049

Developing Chatbot For Academic Record Monitoring in Higher Education Institution

A Heryandi

+ Open abstract   View article   PDF

OPEN ACCESS   012050

User Care Level Audit of Information Data Security at PT XYZ Using Guttman Scale

S Alviana

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012051

Strategies for Improving the Quality of Logistics Courier Services Through Priority Problem-solving Based on Multiclass Classification

R Hendayani and M C Dharmawan

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012052

Optimization of Forest Plant Seeding Based On the Internet of Things

D Hirawan and D Mahendra

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012053

Information System Services Wenow Clean Franchise

I Pangaribuan, M H Ali and S Mauluddin

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012054

The Designing of Warehouse Management Information System

R Fauzan, M F Shiddiq and N R Raddlya

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012055

Forward Engineering in Student Mark Recapitulation Application

S Mauluddin and R Sidik

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012056

The Impact of Implementation of Angklung Learning Application for SLB Part B Deaf using Multimedia-Based Coloring Method on User Satisfaction

D Effendi, L Lestary, B Noviansyah and B Hardiyana

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012057

A Comparison study of DBScan and K-Means Clustering in Jakarta rainfall based on the Tropical Rainfall Measuring Mission (TRMM) 1998-2007

G C Pamuji and H Rongtao

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012058

Design and Development of Coffee Production Information System to Support Coffee Production Productivity in Farmers Group

D Effendi and M I Rismaya

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012059

Analysis of Road and Bridge Conditions by Utilizing WEBGIS Technology to Support The road and Bridge Maintenance Program in Indonesia

Y Afrizal

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012060

Forecasting the Number of Outpatient Patient Visits Using the ARIMA, SES And Holt-Winters Methods at XYZ Community Health Center

I D Sumitra and I Basri

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012061

Application of Supply Chain Management Information System of Inventory at Computer Shop in Jambi City

Ade Indra Saputra and Rahma Wahdiniwaty

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012062

Realtime Notifications On Visitor Tracking Systems Using Android and Arduino

R F Rahman and I D Sumitra

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS　　012063

Designing Enterprise Architecture for Distributor of Consumer Product Using TOGAF ADM

M I Mutakin

+ Open abstract　　🗒 View article　　📄 PDF

OPEN ACCESS   012064

Web-Based Project Management Information System in Construction Projects

M R Fachrizal, J C Wibawa and Z Afifah

+ Open abstract   View article   PDF

OPEN ACCESS   012065

Analysis of Expert System Lung Disease Diagnosis System of Web-Based Disease in Cihaur Puskesmas

A S Sitanggang, A D Damarullah and Wartika

+ Open abstract   View article   PDF

OPEN ACCESS   012066

Designing Enterprise Architecture for Academics Information System Platform using the Open Group Architecture Framework Architecture Development Method

N Zulfarian and I D Rosiyadi

+ Open abstract   View article   PDF

OPEN ACCESS   012067

Implementation of OLAP and K-Medoids Clustering for Accreditation Data Analysis of Study Programs

Ghufron, B Surarso and R Gernowo

+ Open abstract   View article   PDF

OPEN ACCESS   012068

Personality Prediction System Based on Signatures Using Machine Learning

I Maliki and M A Sidik

+ Open abstract   View article   PDF

OPEN ACCESS   012069

Document Image Extraction System Design

N I Widiastuti and K E Dewi

+ Open abstract   View article   PDF

OPEN ACCESS   012070

High Availability Aspects of SDN-IP Reactive Routing

A Friyanto

+ Open abstract   View article   PDF

OPEN ACCESS   012071

Relay Streaming System Model to Social Media Platform for Indoor Activity Broadcasting

R D Agustia and M K Wibawa

+ Open abstract   View article   PDF

OPEN ACCESS   012072

Decision Tree Method with C4.5 Algorithm for Students Classification Who is Entitled to Receive Indonesian Smart Card (KIP)

E Afrianto, J E Suseno and B Warsito

+ Open abstract   View article   PDF

OPEN ACCESS   012073

Enterprise Architecture Planning for Enterprise University Information System Using the TOGAF Architecture Development Method

U Ulmi, A P G Putra, Y D P Ginting, I L Laily, F Humani and Y Ruldeviyani

+ Open abstract   View article   PDF

OPEN ACCESS   012074

ISO 27001:2013 for Laboratory Management Information System at School of Applied Science Telkom University

Alit Yuniargan Eskaluspita

+ Open abstract   View article   PDF

OPEN ACCESS   012075

The Dual-Protocol of the Internet of Things (IoT) Platform for Environment Monitoring System

A Mulyana and JA Ualubun

+ Open abstract   View article   PDF

OPEN ACCESS   012076

Performance Comparison of Anti-Spam Technology Using Confusion Matrix Classification

F Rahmad, Y Suryanto and K Ramli

+ Open abstract   View article   PDF

OPEN ACCESS   012077

Building Serverless Website on GitHub Pages

Prayudi Utomo and Falahah

+ Open abstract   View article   PDF

OPEN ACCESS   012078

Redundancy Detection Of Sentence Pairs In The Software Requirements
Specification Documents With Semantic Approach

E D Oktaviyani and Licantik

+ Open abstract   View article   PDF

OPEN ACCESS   012079

Design of Learning Media for Web-Based Subjects Geography. (Case
study: Class XI majoring in social studies at Citra Nusa Senior High School)

W Wahyuni, R S W Ahmad, N Hasti, I Gustiana and Afifah P Pratiwi

+ Open abstract   View article   PDF

OPEN ACCESS   012080

Geographical Information System of Slums Area in Tangerang Selatan City

N R Radliya, R Fauzan and A R Rabbi

+ Open abstract   View article   PDF

OPEN ACCESS   012081

The Designing of User Acceptance Measurement Tool for Web-Based
Application Interface Using Combination from Nielsen's Method and Questionnaire
Technique

Yusup Maruli and Yusrila Kerlooza

+ Open abstract   View article   PDF

OPEN ACCESS   012082

Work Accident Analysis on the project at PT. X based on the Failure Mode
& Effect Analysis (FMEA) Method

N Santiara and D Rosiyadi

+ Open abstract   View article   PDF

OPEN ACCESS   012083

The Open Group Architecture Framework for Designing the Enterprise
Architecture of ALIT

A Y Eskaluspita and I D Sumitra

+ Open abstract   View article   PDF

OPEN ACCESS   012084

Analysis of Knowledge Management System in Pamulang University
Library Based on SUMI (Software Usability Measurement Inventory)

T Thoyyibah, Agung Trisetyarso, Wayan Saputra, Chul Ho Kang and Bahtiar Saleh Abbas

+ Open abstract   View article   PDF

OPEN ACCESS   012085

Development of Precision Agriculture Models for Medium and Small-Scale
Agriculture in Indonesia

H Maulana and H Kanai

+ Open abstract   View article   PDF

OPEN ACCESS   012086

Implementation of Scrum Framework on Web Development of Mapping
Salted Egg Production

Ginanjar Wiro Sasmito and La Ode Mohamad Zulfiqar

+ Open abstract   View article   PDF

OPEN ACCESS   012087

Application of Linked List Algorithm Based on Multimedia

B Hardiyana, L Fadilah and D Effendi

+ Open abstract   View article   PDF

OPEN ACCESS   012088

Development of Software Quality Assessment Model for Mobile-based
Elderly Fall Detection Software

A Finandhita

+ Open abstract   View article   PDF

OPEN ACCESS   012089

Designing Self-healing Software Using Role-Based Multi Agent System
Approach

Falahah, Kridanto Surendro and Wikan Danar Sunindyo

+ Open abstract   View article   PDF

OPEN ACCESS   012090

Sequential Feature Selection in Customer Churn Prediction Based on Naive Bayes

Y Yulianti and A Saifudin

+ Open abstract   View article   PDF

OPEN ACCESS   012091

Feature Selection Based on Naive Bayes for Caesarean Section Prediction

T Desyani, A Saifudin and Y Yulianti

+ Open abstract   View article   PDF

OPEN ACCESS   012092

Hospital Quality Control System Development

R. Lubis, S Atin and Y A Tambunan

+ Open abstract   View article   PDF

OPEN ACCESS   012093

Model Design of Accounting Information Systems for Village Owned Enterprises (BUMDes)

Supriyati and Ramadhan S. Bahri

+ Open abstract   View article   PDF

OPEN ACCESS   012094

A Predictive Analytic on Data Online Digital News using Systematic Literature Review

Razief Perucha Fauzie Afidh and Zainal A. Hasibuan

+ Open abstract   View article   PDF

OPEN ACCESS   012095

Design of Enterprise Architecture Information System Practicum Scheduling in Computer Laboratory STMIK WIDYA CIPTA DHARMA Samarinda using TOGAF ADM Method

R G Rahmadani and I D Sumitra

+ Open abstract   View article   PDF

Electrical and Computer Engineering

OPEN ACCESS   012096

Android Based Information System Design

A Darmayadi and Y M Izmazatnika

+ Open abstract   View article   PDF

OPEN ACCESS   012097

Temperature and Humidity Monitoring System using Wireless Based Xbee on Hydroponic Plants

A B Emge, I Afrianto and S Atin

+ Open abstract   View article   PDF

OPEN ACCESS   012098

Portable Alphabet Learning Device

T H Suwito and M Aria

+ Open abstract   View article   PDF

OPEN ACCESS   012099

Portable Farming

Sutono and BR Ginting Selvia Lorena

+ Open abstract   View article   PDF

OPEN ACCESS   012100

Motion and Navigation Control System of a Mobile Robot as A Prototype of An Autonomous Vehicle

R Hartono, T N Nizar, I Robani and D A Jatmiko

+ Open abstract   View article   PDF

OPEN ACCESS   012101

Design and Application of a Portable Fingerprint System for Student Attendance Web-Based and Telegram Using Raspberry Pi

Syahrul, M F Wicaksono and Sumarsono

+ Open abstract   View article   PDF

OPEN ACCESS   012102

The Selection of the Correct Accuracy Level Using The Optimal Precision and Accuracy Method

Y Kerlooza

+ Open abstract   View article   PDF

OPEN ACCESS   012103

Human Detection and Avoidance Control Systems of an Autonomous Vehicle

T N Nizar, R Hartono and D Meidina

+ Open abstract   View article   PDF

OPEN ACCESS   012104

General Remote Control Based on Hand Patterns Detection Using Convolutional Neural Network

J Utama and H Y Biu

+ Open abstract   View article   PDF

OPEN ACCESS   012105

Design and Implementation of Doorcam in Home System using Raspberry Pi

S I Lestariningati

+ Open abstract   View article   PDF

OPEN ACCESS   012106

Maximally Stable Extremal Regions and Naïve Bayes to Detect Scene Text

E Rainarli

+ Open abstract   View article   PDF

OPEN ACCESS   012107

Build a Microcontroller Based Interactive Module as A Learning Medium in Vocational Secondary Schools

B Kurniawan

+ Open abstract   View article   PDF

OPEN ACCESS   012108

Virtual Simulation System with Various Examples and Analysis Tools for Programmable Logic Controller Training

M Aria, J Utama, F Fauzia, M Rizal, M Fahmi and M Yudha

+ Open abstract   View article   PDF

OPEN ACCESS   012109

Fingerprint Matching Using Bozorth3 Algorithm and Parallel Computation on NVIDIA Compute Unified Device Architecture

S Supatmi and I D Sumitra

+ Open abstract   View article   PDF

OPEN ACCESS   012110

Design and Implementation of Sembako-ATM using IoT based on Microcontroller and Web Application

H Hidayat, Y F Rahmatulah and M F Wicaksono

+ Open abstract   View article   PDF

OPEN ACCESS   012111

Study and Performance Evaluation Binary Robust Invariant Scalable Keypoints (BRISK) for Underwater Image Stitching

D A Jatmiko and S U Prini

+ Open abstract   View article   PDF

OPEN ACCESS   012112

Support Vector Regression for GPA Prediction

K E Dewi and N I Widiastuti

+ Open abstract   View article   PDF

OPEN ACCESS   012113

Development of Automatic Health Testing Measurement Model for High School Students in West Java

B Herdiana and A Ridwan

+ Open abstract   View article   PDF

OPEN ACCESS   012114

Cropping Method on Grayscale Images for Periapical Radiographs of Human Teeth

Linda Wahyu Widianti, Sunny Arief Sudiro, Sarifuddin Madenda and Johan Harlan

+ Open abstract   View article   PDF

OPEN ACCESS   012115

Groundwater Potential Investigation Using Geoelectric Method with Schlumberger Electrode Configuration in Catur Rahayu Village, Dendang District, Tanjung Jabung Timur Regency, Jambi Province

Tri Rahajoeningroem and Bagus Indrajana

+ Open abstract   View article   PDF

OPEN ACCESS   012116

Data Mining in Sales Data Grouping

Supriyati and S R Abdillah

+ Open abstract   View article   PDF

Entrepreneurship & Technopreneurs

OPEN ACCESS   012117

E-Commerce for Agriculture

E S Soegoto and A Nugraha

+ Open abstract   View article   PDF

OPEN ACCESS   012118

Analysis on User Interfaces Readability: A Case Study of Instagram

A D Subarna and A S Arianti

+ Open abstract   View article   PDF

OPEN ACCESS   012119

Designing Parking Lot Finder Application

E S Soegoto and M Indra

+ Open abstract   View article   PDF

OPEN ACCESS   012120

Designing Electronic Menu Applications for Restaurant Businesses

U Narimawati and A Pangestu

+ Open abstract   View article   PDF

OPEN ACCESS   012121

E-Wallet Effects on Community Behavior

L Wulantika and S R Zein

+ Open abstract   View article   PDF

OPEN ACCESS   012122

The Influence of Digital Wallet

E S Soegoto and M B R Sumantri

+ Open abstract   View article   PDF

OPEN ACCESS   012123

Analysis of the Effect of Web-Based Information System

E S Soegoto and L F Ma'wa

+ Open abstract   View article   PDF

OPEN ACCESS   012124

Analysis of Electronic Wallets Use Patterns among Students in Online Transportation Services

R D Santy and D Haninawati

+ Open abstract   View article   PDF

OPEN ACCESS   012125

Web Based Online Inventory Information System

E S Soegoto and A F Palalungan

+ Open abstract   View article   PDF

OPEN ACCESS   012126

Design of Information System Human Resource Management

W Novianti and F Qadri

+ Open abstract   View article   PDF

OPEN ACCESS   012127

Electronic Wallet as a Payment Transaction Instrument

A Rizaldi and F A Faruqi

+ Open abstract   View article   PDF

OPEN ACCESS   012128

Pavement Design using Environmentally Friendly Porous Concrete

B S Sir and S M Setiana

+ Open abstract   View article   PDF

OPEN ACCESS   012129

Information Technology for Coffee Industry

S M Setiana and A Khaerani

+ Open abstract   View article   PDF

OPEN ACCESS   012130

Hydroponic Technology in Agriculture Industry

I Prayoga and R A Putra

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012131

E-commerce in Farmers Communities

T Fidowaty and R Y Supriadi

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012132

E-commerce in Supply Chain

A Jannah and H Hassanah

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012133

Effect of User Interface and User Experience on Application Sales

M A T Pratama and A T Cahyadi

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012134

Application of Hec-Ras Technology to Irrigation and Water Building in Agricultural Businesses

B Kurniawan, F S Sasmita and S Alviana

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012135

Information System Application for Palm Oil and Rubber Plantation Sales

P Nugraha and T Tawami

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012136

Decision Support System for Public Transportation Selection

D S Soegoto and P Ramadhani

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012137

Developments of Information Technology and Digital Startup Sector of Agriculture in Indonesia

D S Soegoto and M Faridh

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012138

Desktop Based Application for Inventory Management

D S Soegoto and R F Nugraha

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012139

E-Wallet as a Payment Instrument in the Millennial Era

D S Soegoto and M P Tampubolon

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012140

Agribusiness Information System of Dragon Fruit Planation

Y P Sihaloho and A Febriansyah

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012141

Development of Enterprise Resource Planning using Blockchain

A R Komala and I Gunanda

+ Open abstract　　　📄 View article　　　📕 PDF

Architecture, Urban & Regional Planning, and Civil Engineering

OPEN ACCESS　　　　　　　　　　　　　　　　　　012142

Effect of Activation Code / Encryption Code on Digital Goods on Digital Right Management

A Gifar and H Purnomo

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012143

Utilization of Information and Communication Technology in Agriculture

T V L Gaol and M R Gustira

+ Open abstract　　　📄 View article　　　📕 PDF

OPEN ACCESS　　　　　　　　　　　　　　　　　　012144

The Effect of Computer-Based 3D Visualization

D M Ramadhanty and T Handayani

+ Open abstract   View article   PDF

OPEN ACCESS   012145

Utilizing Technology of Dynamic Faces on Buildings

D P M Fattah and D Kurniasih

+ Open abstract   View article   PDF

OPEN ACCESS   012146

Sustainable Building Materials

D A Suhamad and S P Martana

+ Open abstract   View article   PDF

OPEN ACCESS   012147

Use of 3D Animation Software in Visualizing Architectural Works

W Hadiyatna and Andi Harapan S

+ Open abstract   View article   PDF

OPEN ACCESS   012148

The Efficiency of Steel Material as Buildings Construction

S O Putri and Firmansyah

+ Open abstract   View article   PDF

OPEN ACCESS   012149

The Influence of Technology on Architecture Design 4.0

M Fadjri and Y A Ekawardhani

+ Open abstract   View article   PDF

OPEN ACCESS   012150

Architecture and Design in the Digital Age

R A Robinson and I Tarmawan

+ Open abstract   View article   PDF

OPEN ACCESS   012151

Recycled Wood Technology for Wall

H Hafilda and A B Hardoyo

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S Suhendar and L Warlina

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Design of Smart Trash Bin

R P Chandra and T Tawami

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D Fatimah and B Z Syaifudin

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Utilization of Sawdust as Interior Acoustic

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Designing Friendly Environment for Pedestrian by Visual Perception

A Pelayati and D Andriani

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Synomorph of Behaviour Setting in Architecture Enhance the Green Design

Wanita Subadra Abioso

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Kampong KB Public Open Space Design Based on a Participatory

N C Aditya, T W Natalia, L N Imaniar and S Astuti

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Land Use Change and Suitability Analysis in Coastal Area

L Warlina and A Ikhsan

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Relationship between Farmer Characteristics and Gadget Using in Rural Area for Improving Regional Development

S S Aulia

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Designing Enterprise Architecture for Public Health Center Based on TOGAF Architecture Development Method

Y P Putra and A Hadiana

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R Adibowo and K Mahardika

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Implementing the Shortest Time Route Search Algorithm in Semarang Using the Best First Search Method

N Wibowo, C E Widodo and K Adi

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Potential of Sea Passenger Movement Post Ports Development in Kepulauan Seribu

K Mahardika

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Flood Control Reduction Analysis using HEC-RAS due to Local Floods in Central Jakarta

V Pratiwi, B P Yakti and B E Widyanto

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Effect of Change in Land-use to High Pattern of Inundation on Sub-River System of Lowland Urban River

S. A. Hamim and F. Usman

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Experimental Study Improving The Friction in The Surface of Cold Form Steel Connections Using Adhesive

Y D Setiyarto

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Building Façade of the Architect Richard L.A. Schoemaker in Bandung

S P Martana, J C Yapsie, Abdurrahman, F S Prasetyo and I D N Syauqi

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Industrial Engineering

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Product Quality Improvement by Using the Waste Assessment Model and Kipling Method

Julian Robecca, I Made Aryantha Anthara, Monalisa Silaban and Maureena Ronahot Situmorang

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A Yussaivi, D Suhartanto and Moch. Edman Syarief

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I M A Anthara, J Robecca and M L Lubis

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Design Models for Estimating Customer Volume Based on Competitors

I Andriana, H Henny, C M Saputra and D Darmawan

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Designing Universal Smartphone Case with Solar Powered Chargers

H Henny, D Purwadi, H Hardianto and O Widilestariningtyas

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Design for Human Safety and Health in Manufacturing System

H Henny, A Jaelani, H Haryanto and I Andriana

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Design and Implementation of Doorcam in Home System using Raspberry Pi

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Design and Implementation of Doorcam in Home System using Raspberry Pi

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Abstract. This paper discusses how to develop a doorcam system that is implemented at home at an affordable price. The system was built using a Mini PC Raspberry Pi, and a Pi camera to obtain an affordable price for the doorcam system implementation. The results of tests that have been carried out were the system had succeeded in notifying the homeowner when there were guests who were visiting the house. The system will send a notification message and display the image captured by Pi camera via the Telegram application when the guest press bell button. The system worked with delay below 5 seconds. This system can work well when done during the daytime, because the Pi camera used is not equipped with lights, so the captured images that are sent cannot show guests coming to visit in front of the house.

1. Introduction

Internet of Things (IoT) can be described as connecting devices used daily such as computers in the form of PCs, laptops, tablets, smart phones, televisions, sensors and actuators to the Internet where devices are connected intelligently forming communication between things and humans [1]. The current implementation of IoT such as smart home has been widely implemented. The development of this technology is to add a doorcam system feature that can make it easier for homeowners to know guests who visit their homes, both when they are at home or outside. But not everyone uses this feature because the price of the system is not affordable [2].

Mini PC such as Raspberry Pi in designing a doorcam system to produce a systems for an affordable price can be a solution. The selection of Raspberry Pi is due to its cheap price, low power consumption, and the availability of open source software in developing applications [3][4]. The advantage of Raspberry Pi is that this small computer has been widely implemented in the development of IoT technology, because apart from its reliable device and has a discussion community that is easily found on the Internet [5].

The purpose of designing and implementing this system is to produce a doorcam system at an affordable price that can be utilized in all homes and homeowners can have a safe comfort in their house because they know guests who come to their homes before answering and opening their doors.

2. Method

Smart system and IoT are driven by combination of three things: sensors and/or actuators, connectivity and people/process. The components as illustrated in the Figure 1.
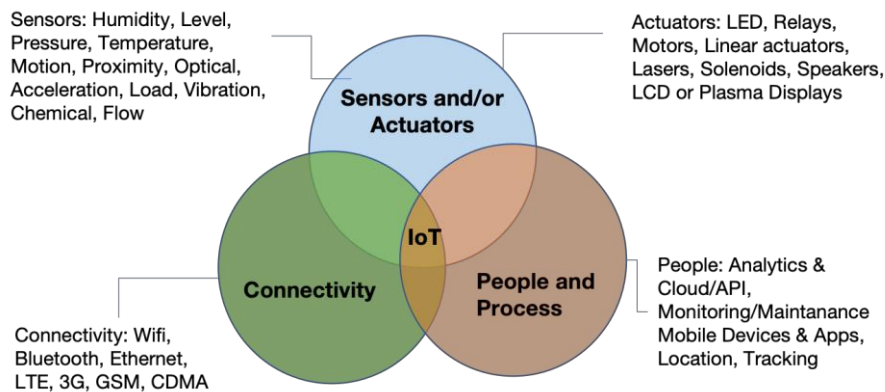
Figure 1. IoT Component

The components explanation:

- Sensors: The object is able to extract various data from its environment such as humidity, level, pressure, temperature, motion, proximitym optical, acceleration, load, vibration, chemical, flow [6].

- Actuators: The object is able to act within its environment: emit light, make sound, push button, etc.

- Connectivity: The embedded system can use a range of connectivity to connect with other devices or the Internet. Some of example are such as wifi, Bluetooth, Ethernet, LTE, 3G, GSM, CDMA, etc[7].

- People and process: The information transmitted via the chosen connectivity can be used by people and processes to take action.

3. Results and Discussion

Figure 2 depicted the illustration of doorcam system. The doorcam system working with the following steps: when guests arrive and visite the house, they will press the bell button on the Raspi LCD display where it is usually put near to the door or gate. Then, system will start taking pictures using Pi's camera and then the system will send picture and text messages to the homeowner through Telegram application that has been installed on the homeowner's smartphone. From the Telegram application, the homeowner can send a message back whether he wants to meet immediately or not. The reply message will appear on the LCD screen that can be seen by the guest.

Homeowners can find out who is coming to their house whether they are inside or outside the house. Guests can also leave voice messages recorded by the system, and the message is sent via the telegram application.

IoT components used in this system are actuators in the form of LCD screens, connections using wifi technology, and people who use this system are guests and homeowners using their smartphones to be able communicate with the system. Hardware specification for this system described on Table 1.
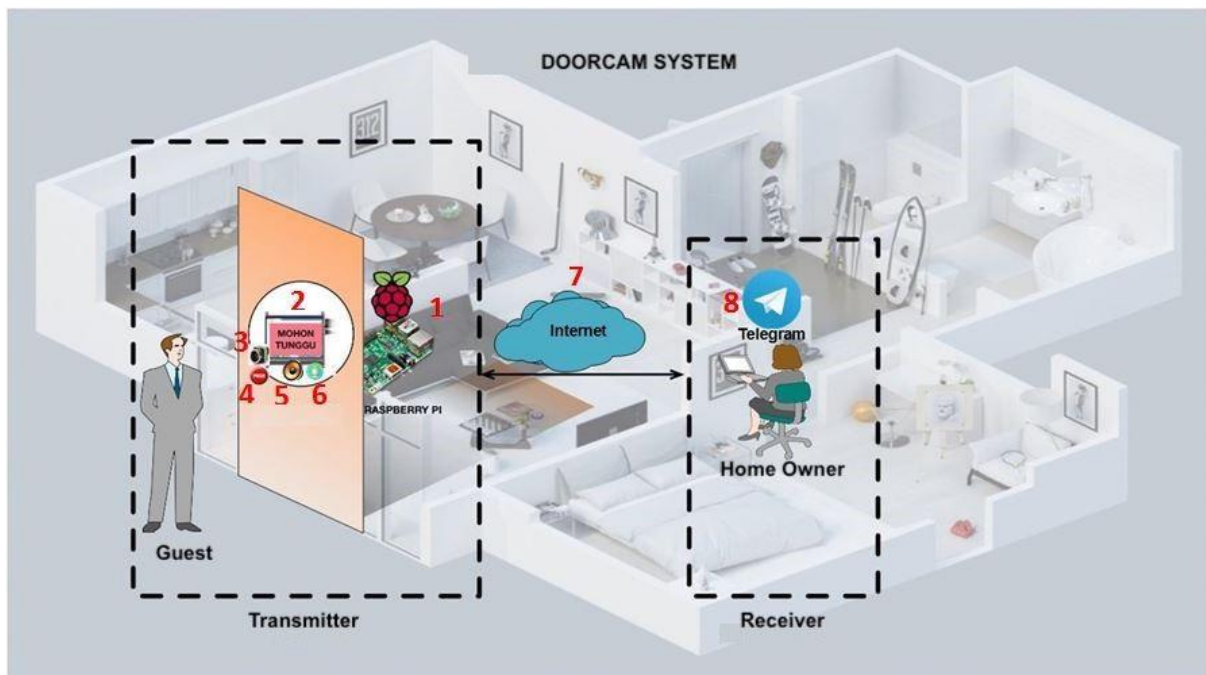
Figure 2. Doorcam System Illustration

Table 1. Hardware Specification

Item	Specification
Mini PC	Raspberry Pi 3 Model B+
Camera	Pi Camera
Display	Raspberry Pi LCD

Figure 3 depicted the interface on LCD monitor telling guest to push the button to inform the homeowner. While the guest waits in front of the door, the system sends message to homeowner. Figure 4 displays the message from homeowner. If the homeowner is not at home, the system will enable the button "Kirim Pesan Suara", so the guest can start to record voice message for 7 seconds, and then the system sends the message through Telegram application. Figure 5 depicts notifications on Telegram application.

The test result shows the average delay of this system is below 5 seconds. This total delay counts from the system received instruction to captured image untill the message arrived on smartphone. This system will be able to produce maximum output if this system is used before sunset, where there is still good lighting. This is because the desired system is that the system can transmit data with a minimum delay, so a small pixel camera is chosen but is still good enough to display recognizable faces. the drawback is that when this system is used at night, the image sent will be a black image because when it does not get good lighting.

We can use a better camera than a Pi camera with a more expensive price. This can be adjusted to the existing budget conditions. If it is compared to the doorcam on the market, it usually costs more than IDR 2,000,000 with a camera that is equipped with night vision, while this system can cost only under IDR 1,000,000.

Figure 3. The Interface on LCD Monitor Telling Guest to Push the Button to Inform the Homeowner.

Figure 4. System Display the Message from Homeowner

Figure 5. Notification on Telegram Application

4. Conclussion

From the test result that has been done, the doorcam system that was designed has succeeded in notifying the home owner when there are guests who are visiting. The drawbacks of this system images has noise due to the lighting factor when taking pictures, especially at night. Moreover, the system still suffer from delay below 5 seconds. Future work is to replace the camera that has infrared, and reducing the complexity of algorithm so that the system can work faster and efficient.

Acknowledgment

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