CAR ACCIDENT DETECTION SYSTEM USING THE INTERNET OF THINGS (IOT) ADDITIONAL INFORMATION DETAIL AS INSURANCE CLAIM PT. AXLE ASIA.

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ABSTRACT

PT. Axle Asia is an insurance broker that helps each client to file an insurance claim against accidents, in this case is an accident to four-wheeled vehicles (cars). However, at the time of collecting accident information, sometimes many clients forget or do not remember the exact details of accidents that occur. This makes the process of gathering information hiccup.

This study aims to solve the problems of forgetfulness or not knowing precisely detailed accident information needed, by making the accident detection system by using the Internet of Things technology.

The results showed that the accident detection device capable of detecting the location and time of the accident that able to solve the problem of forgetting or ignorance precisely detailed accident information, and will be processed by web application of accident detection system.

Based on the study it can be concluded that the accident detection system using the Internet of Things technology can accelerate the process of making detailed accident information when clients forget or do not know the exact details of accidents that occur.

Keywords: Accident Detection System, the Internet of Things, IOT, Insurance Claims.

1. PREFACE

The need for insurance services become a necessity, both for individuals and groups of business, because the insurance is one of financial management in the governance of domestic life in the face of risks to property owned. Insurance is a good and effective method is used because the benefits. Promised protection to the insured against risks to be faced by individuals and companies. One company that is engaged in the area of insurance is PT. Axle Asia Jakarta

PT. Axle Asia is a brokerage firm engaged in the area of insurance. The company became a bridge, as well as an intermediary between a client with an insurance company. One of the functions of the company mediating the filing of insurance claims in four-wheeled vehicles (cars). Based on the interview with Mr. Tri Pamungkas (16-02-2016) in 2013 there were 20 accident claims, 58 accident claims (2014), 25 accident claims (2015), and 8 accident claims (2016). Within the last 3 month, occurred 8 filing an accident claim for four-wheeled vehicles (cars) and 15 filing accident claims for the last 5 months, for the same vehicle.

PT. Axle Asia has an obstacle in connecting clients with the insurance company, particularly when making a claim against the incidence of accidents that occurred in the four-wheeled vehicle. Many clients who in this case is an individual (individuals) and corporations (companies) do not know the exact details on the accident information when filing a claim, such as the date and time of the incident, location, and the approximate speed of the vehicle at the time of the accident.

Based on the background of the problem, the researchers are interested to creating a system which uses the Internet of Things (IoT) technology for detecting an accident on a four-wheeled vehicles (cars) which is able to produce detailed information about the accident that happened to improve efficiency in information retrieval for filing claims an accident that results will be manifested in a final report entitled "Development of Detection System in Car accidents Using Technology Internet Of Things (IOT) for Additional Information Details Filing Insurance Claims to PT.Axle Asia".

2. LITERATURE

2.1 Insurance and Insurance Claims

According to the KUHD 246 "Insurance is an agreement by which a binding to an insured, to receive a premium, for reimbursement to him for damage or loss of expected benefits that may be experienced as an event that is not necessarily".

Understanding of other insurance is a transfer of risk from the first party to the other party. In the delegation ruled by the rule of law and the enactment of the principles and teachings which are universally shared by first-party and other parties. From an economic standpoint, insurance means a collection of funds that can be used to cover or provide compensation to those who suffered losses.

The insurance claim is a formal request addressed to the insurance company related financial protection or indemnity of the insured person in accordance with the contract agreed between the insured with insurance services company.

2.2 Internet of Things

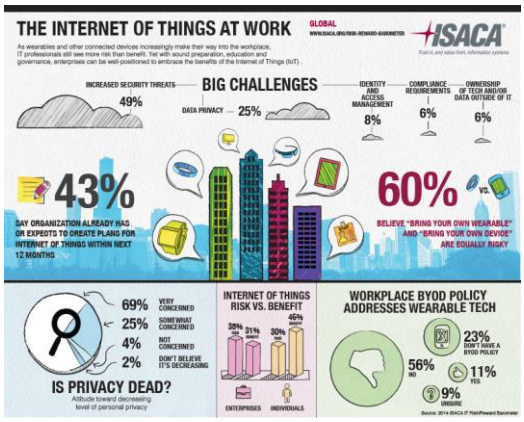
Internet of Things is a technology that allows us to connect the machine, equipment, and other physical objects with a network of sensors and actuators to obtain data and manage their own performance. Internet of Things is able to extend the reach of information technology. There are so many possibilities that arise from the ability to monitor a physical things that inspire the advancement of electronic-based wave of innovation and enthusiasm. Another opinion states that the Internet of Things (IoT) is a network of objects that are connected to each other through the Internet, and communicate independently without human intervention [1].



Picture 1. Internet of Things

According to Miller, technically the Internet of Things (IOT) involves a relatively small devices and those devices have IP addresses that connect to other devices through the Internet [2]. It allows the interaction between the device with other devices for sharing information.

Based on the opinion of the miller pointed out, the Internet of Things technology can be utilized as a profitable technology.



Picture 2. Benefit of IoT

If a technology has a value and profits, then the technologies actually will be useful and beneficial also for human life. A value and benefit from the application of the Internet of Things in the environment will have the original values in every aspect, which vary according to the type of its application [3].

IoT services often provide opportunities to capture data, which can be used to improve the service offered, perhaps through better customer service or smarter support. For example, diagnostic data about the functioning of a boiler could be used to identify systems at risk of breakdown and schedule an engineer visit before they fail. You might even package the cost of the service contract with the monthly fee for maintaining the service. Users may be happier to pay for something like this than to cover the cost of maintaining your internet servers!

Many IoT systems are tools: they require the user to frame their own problem and configure the system to solve it. Consumers tend to look for products that promise to solve a particular problem for user and come already configured to do that. They expect the cost and effort of using the product to be in proportion to the value it brings them.

IoT creates new opportunities for information gathering, sharing, remote control and automation. But there are common pitfalls that can limit a product to early adopter markets. In particular, be careful of introducing new complexity to mature consumer products.

2.3 Arduino Uno

Arduino Uno is one of the products labeled Arduino actually is an electronic board containing the microcontroller ATmega328 (a puck that functionally acts like a computer) [4].



Picture 3. Arduino Uno

With the addition of several components, arduino can be used to support the application of technology IOT (Internet of Things).

In arduino there are some pins are divided into 2 pieces categories, namely digital pin and analog pin. Digital pin comprises 14 pin where the pin starting from 0 to 13. The digital pins are used for digital signaling, which is worth only be 0 and 1. Analog pin consists of six pieces of pin where the pin starting from the pin A0 to A5. The analog pins used for analog signals.

2.3 Accelerometer

The accelerometer sensor is a traduser used to measure linear acceleration, measure and detect vibrations, and measure the acceleration due to gravity. Sensor accelerometer measures acceleration due to the movement of objects attached to it [5].

The working principle of this transducer is based on the laws of physics that if a conductor is moved through a magnetic field, or if a magnetic field is moved through a conductor, then there will be an induced voltage in the conductor. Accelerometer placed on the surface of the Earth can detect the acceleration of 1g (the size of the earth's gravity) at the point of the vertical, for the acceleration caused by the horizontal movement of the accelerometer will measure acceleration directly when moving horizontally.



Picture 4. Accelerometer ADXL-345

2.3 GPS Receiver

Global Position System (GPS) is a navigation system that can provide information based on the position of a device connected to it via satellite. there is a tool that can receive input on it, such a device called a GPS receiver [6]. By using the GPS module we can obtain the position of an object or device that is embedded inside a device such as GPS Receiver.



Picture 5. GPS Skylab-SKM53

The Skylab SKM53 Series with embedded GPS antenna enables high performance navigation in the most stringent applications and solid fix even in harsh GPS visibility environments. It is based on the high performance features of the MediaTek 3339 single-chip architecture, Its –165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before [7].

The 6-pin UART connector design is the easiest and convenient solution to be embedded in a portable device and receiver like PND, GPS mouse, car holder, personal locator, speed camera detector and vehicle locator.

2.4 Ethernet Shield

Ethernet shield arduino is a support device that has a function to connect the arduino with other devices using RJ45 port. In general, ethernet arduino shield is used to connect the arduino to a router or other device that allows arduino to source connectivity internet network.



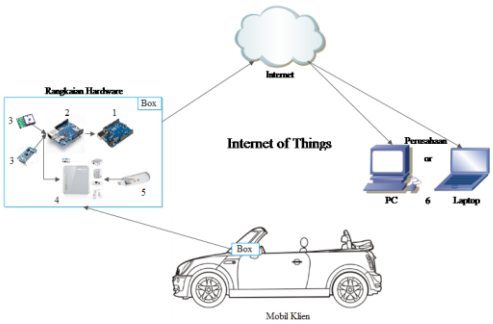
Picture 6. Ethernet Shield

The Ability of arduino ethernet shield in connecting arduino to an other device to get Internet connectivity comes from a chip called Wiznet W5100. The Arduino Wiznet Ethernet W5100 Shield allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip providing a network (IP) stack capable of both TCP and UDP [8]. The Ethernet Shield supports up to four simultaneous socket connections.

3. DISCUSSION

3.1 Architecture Analysis System

Architecture analysis is a process to describe the physical system to be built and also the components supporters. Here is a system architecture that will be built as in the picture 7



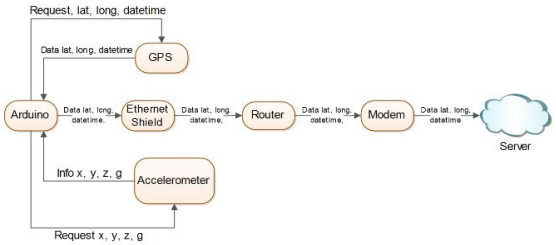
Picture 7. System Architecture

The following is an explanation of Architecture system as shown in picture 7.

a. Arduino Uno, serves as the main control center data collection that is detected by the sensor and transmit the data that has been generated by the sensor into the server. Arduino has Input Output is generally classified into 2 of the I / O and digital I / O analog. Arduino digital pin is used to read input and output the voltage digital form. Digital voltage is divided into two, for the voltage of 0 - 2.5 V will be read as 0 and voltage 2.6 - 5V will be read as 1. For digital output, pin Arduino will issue a signal voltage of 0V for 0 and 5V for tense signal 1. Some Arduino digital pin functions as a generator and reader signal pulses of high-speed digital (Pulse Width Modulation). Arduino analog pins used to read analog voltage input. Analog voltage which can be read is in the interval 0-5V. Analog voltage that goes to pin analog will go into the ADC (Analog Digital Converter). ADC in Arduino Uno have 10bit resolution,so ,when the voltage is 0V, the ADC will read 0 and when 5V ADC will read 1024. Pin Tx and Rx is used for serial communication lines, Tx as a data transmitter pin and Rx as a receiver data pin.
b. Ethernet Shield has a function as a board ethernet service provider. The board will bridge Arduino ethernet to connect to a LAN network connected through a router.
c. The sensor has a function as collecting the data required. In this case the data is detailed data about accidents suffered by the vehicle. The sensor is a GPS receiver and accelerometer. GPS data is displayed in the message format. Almost all GPS receivers have NMEA formatted output. Standard NMEA formatted in a data line or can be called in a sentence. Each sentence contains various bits of data organized in a comma-separated format. Once the GPS module active, NMEA formatted data is sent from pin series (TX) at baud rates.
d. A microcontroller can read NMEA data, pin TX and RX on the GPS must be connected to the microcontroller through a digital pins on the Arduino. Arduino platform can parse NMEA data easily with the help of library TinyGPS.
e. Here is an example of th GPS data format NMEA: $GPRMC,235316.000,A,4003.9040,N,10512.5792,W,0.09,144.75,141112,,*19. $GPGGA,235317.000,4003.9039,N,10512.5793,W,1,08,1.6,1577.9,M,20.7, M,,0000*5F. $GPGSA,A,3,22,18,21,06,03,09,24,15,,,,,2.5,1.6,1.9*3E. The description of these data are: Time: 235317.000 is 23:53 and 17.000 second, based on Greenwich Mean Time. Longitude: 4003.9040,N is a latitude in decimal degrees, North. Latitude: 10512.5792,W is the longitude in decimal degrees, West. Number of satellites seen: 08. Altitude: 1577 meters.
f. The Data of Accelerometer have input sensor such as distance measurement (measurement range), non-linear data (nonlinearity), axis alignment error (Inter Axis Alignment Error), cross-axis sensitivity (cross-axis Sensitivity). As for output, the result resolution is a whole range of gravity, ranging from 2g, 4g, 8g and 16g.
g. The router has a function as to direct data packets to a specific location or information from one network to another. The router will be connected to arduino via UTP cable with RJ45 connectors.
h. Modem has a function to perform the process of laying an information signal to the data on the carrier signal to be sent to the user through a particular medium, this process is usually called the modulation process. The signals generated by the modem will bring data about details of the accident to the server.
i. The computer has a function to access data on the server via a web browser when the computer is connected to internet connection

3.2 Analysis of Data Communications

Data communication is a very important thing, because of the absence of data communication, an application that is being built can not run properly or optimally. Data communication applications used in the prototype of this system is by using TCP / IP and the methods used for the transmission of data packets is using the post method.



Picture 8. Flow Data Communications Architecture

The following is an explanation of the picture 8:

a. Arduino deliver power and also requesting information to each sensor (GPS and accelerometer).
b. Accelerometer deliver information about unnatural number changes of each axis (x, y, z) to arduino, that indicating the occurrence of accidents.
c. GPS sends data to arduino such as latitude, longitude, and datetime based on the detection of the crash sensor accelerometer.
d. Arduino sends the data to the internet via Ethernet Shield.
e. Ethernet shield distribute the data via a router.
f. The router sends the data to the Internet through a modem that is connected to the internet.

g. Information such as latitude, longitude, and datetime sent to the server.

3.3 Hardware Requirements Analysis

Hardware is one thing that is very important in the manufacture or construction of a system. The system will not be able to run properly if it is not supported by adequate hardware components. Here are the specifications of the hardware used by the client company :

Table 1. Specifications detectors

Hardware	Detail
Arduino Uno	Atmega328
Ethernet Shield	Wiznet W5100
GPS Receiver	Skylab SKM53
Accelerometer	Gravity
Router	TL-MR3020
Modem	4G-E3276

3.4 Accident Detection Data Analysis

Analysis of crash detection device is an analysis to generate an overview of the data generated by the detector (accelerometer sensor). Here is the data generated by the detector (accelerometer sensor):

Table 2. Experiment Conditions

No	Conditions
1	Car Stopped
2	Car Hit From Front
3	Car Hit From Right
4	Car Hit From Left
5	Car Hit From Behind
6	Forward Rotation Occurs on The Car
7	Rotation Occurs to The Rear on The Car
8	Car Rotates to The Right
9	Car Rotates to The Left

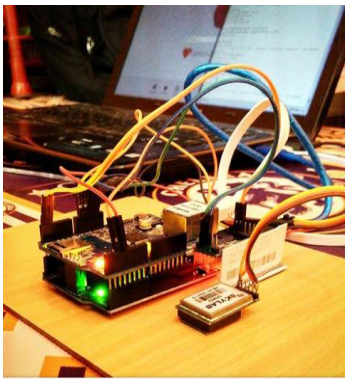
Table 3. Data Axis x, y, And z on The Device

No	Axis		
	x	y	z
1	0.27	1.02	-9.53
2	0.27	1.06	-9.57
3	0.24	1.14	-9.46
4	0.27	1.14	-9.49
5	0.24	1.06	-9.53
6	-0.20	-9.81	-1.77
7	0.98	10.2	-0.35
8	10.79	1.53	0.35
9	-9.38	1.49	0.47

4. TEST RESULTS

Testing accident detection system was tested through several stages of scenarios, to test the communication between the detector and the system. Here are the stages of scenario :

a. Based on Table 3, the parameters of the accident on the deviceis set with a number greater than 5 and less than -5 for x, and y.
b. Accident detection device (picture 9), pluged into a remote control (picture 10).



Picture 9. Accident Detection Device



Picture 10. Remote Control

c. Remote control car was hit from the front (1), Right (2), Left (3), and rear (4) by a remote control car more. Here is an axis movement detected by the tool as shown in table 4:

Table 4. Skenario c

No	Axis		
	x	y	z
1	0.27	1.02	-9.53
2	0.27	1.06	-9.57
3	0.24	1.14	-9.46
4	0.27	1.14	-9.49

From Table 4, visible when the x-axis and ya do not change so that the tool does not detect it as an accident and do not transmit the data from the sensors to the system gps.

d. Remote control car mounted detectors then reversed (rotation) in various directions that produce data as shown in Table 5

Table 5. Skenario d

No	Axis		
	x	y	z
1	1.26	9.77	-3.02
2	10.79	1.53	0.35
3	-9.38	1.49	0.47

From Table 5, it appears that the detector detects the presence of an accident suffered by a remote control car, where the car remote control to rotate toward the rear (1), Right (2), and left (3). Under these conditions the detector sends the data obtained from the GPS system.

e. Remote control cars back to do the rotation in different directions to see if the system receives data transmitted by the detector available in the car remote control.

f. Admin open a web-based application (system) and go into the menu history (history of accidents) contained on the admin page. Then the obtained results as shown in Picture 11.

IOT AXLE : Sheet1

		Accelerometer			GPS		
Date	Time	x	y	z	Latitude	Longitude	ID
1/26/2017	6:09:15 AM ICT	1.26	9.77	-3.02	-6.88	107.62	AD0001
1/26/2017	6:09:24 AM ICT	1.22	9.81	-2.86	-6.88	107.62	AD0001
1/26/2017	6:09:40 AM ICT	1.22	9.89	-2.98	-6.88	107.62	AD0001
1/26/2017	6:09:50 AM ICT	1.22	9.85	-2.86	-6.88	107.62	AD0001
1/26/2017	6:10:08 AM ICT	1.18	9.81	-3.02	-6.88	107.62	AD0001
2/7/2017	11:24:30 AM ICT	-0.2	-9.81	-1.77	-6.88	107.623	AD0001
2/7/2017	11:26:28 AM ICT	0.98	10.2	-0.35	-6.88	107.62	AD0001
2/7/2017	11:27:57 AM ICT	10.79	1.53	0.35	-6.88	107.62	AD0001
2/7/2017	11:28:54 AM ICT	-9.38	1.49	0.47	-6.88	107.62	AD0001
2/7/2017	11:39:14 AM ICT	10.71	1.49	1.1	-6.88	107.62	AD0001
2/7/2017	11:39:22 AM ICT	10.71	1.45	0.98	-6.88	107.62	AD0001
2/7/2017	11:39:31 AM ICT	10.75	1.37	1.06	-6.88	107.62	AD0001

Sheet1

Picture 11. Accident History Data

From Picture 8, it appears that the tool successfully transmit data into the system in the form of the date, time, the data x, y, z, the crash site in the form of coordinates (latitude and longitude), and id detection devices that transmit data.

g. Once the data from the detector into the system, the data location coordinates can be generated in the form of maps by using reverse geocoding functionality.



Picture 12. History Display List System

From Picture 12, visible when the data is entered into the system may be in genarate by pressing the button (the button) green that reads "See Locations". Then after pressing the button, the system will immediately display the crash site in the form of maps as the picture 13.

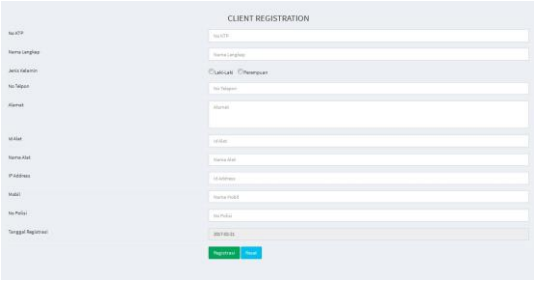


Picture 13. Display Location Accident

From picture 13, it looks if the system can display the location of the accident based on the coordinates transmitted by the detector of the GPS module. Information generated at the point of the crash site in the form of maps and addresses. In the picture 10 appears that address the accident was "Bandung, Bandung City, West Java, Indonesia".

In addition to testing the communication between the detector with the system, in this study also tested the functionality contained in the system (web-based application), among others:

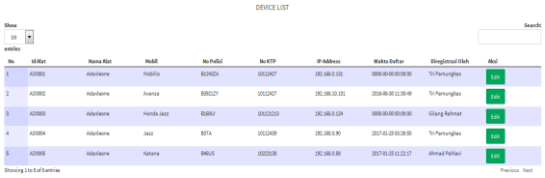
a. Functionality for registering clients with the detector accident. This functionality is used to register a client who wants to use detectors to obtain detailed information data about accidents.



Picture 14. Form Registration

From picture 14, it appears that there is a registration form client information and also information detection devices. It points out that such functionality was successfully executed as shown in picture 15, and the picture 16 that the data tools and clients have successfully entered from from registration.

b. Functionality to manage a list of all detectors accidents have been registered. This functionality is used to view a list of tools that have been registered by the system. This function can also be used to modify any information or data on the detector.

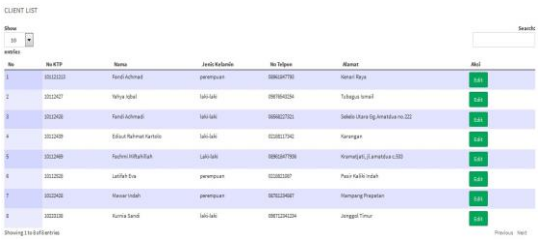


Picture 15. Device List

From picture 15 it appears that this functionality can be run either by generating output as expected. There is also a green edit button to change the wrong data on crash detection device.

c. Functionality to manage a list of clients who have signed up to the detector. This functionality is used to view the list of clients who have registered to use detection equipment accident

.



Picture 16. Client List

From picture 16 it appears that this functionality can be run either by generating output as expected. There is also a green edit button to change the data or incorrect information on the client.

d. Functionality to generate reports on the number of accidents that occur every year. This functionality is used to generate reports on the number of accidents that occur each year.



Picture 17. Accident Report

Of the 17 pictures, visible when the highest number of accidents occurred in January of 4 pieces accident, while other months has not detected any accidents that occur. In addition to the number in the report is also displayed in graphs, charts, and also can be saved into a PDF so that the company can store the data and print it in the form of hardfile.

5. CLOSING

5.1 Conclusion

Based on the results obtained from studies conducted in the preparation of this thesis as well as referring to the purpose of research, it can be concluded :

a. With this system the broker can more easily obtain detailed information (location and time) crash when the client does not remember or do not know exactly detailed accident information.
b. With this system the process of filing car accident claims to be faster at processing the filing of claims by clients who do not remember or know exactly detail information (location and time) crash.
c. With this system the client becomes easier to make a claim car accident while not remember or know secarai details about the time and location of the accident.

5.2 Suggestion

This system still needs further development for the future so that not only detects when a car accident changed the rotation but also can detect an accident when hit by a car at the front, rear and side by adding a vibration sensor in the detector

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