Rice Donation System in Orphanage Based on Internet of Things, Raspberry-Pi, and Blockchain

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***Abstract* — IoT utilization in daily lives is very potential and can be applied in various fields, unfortunately the implementation in the social field still lacking. The large number of orphanages in Indonesia caused information distribution not easily available, however donors find it difficult to get the right information about food reserves, especially rice stock in orphanages. This paper proposes an IoT-based system where rice stocks in orphanages can be detected by Raspberry pi which is connected to sensors, data information from raspberry-pi connected to the network that can be accessed and monitored by mobile applications. This application designed for service providers, donors and rice suppliers. Donors send rice through financial transactions with service providers, and rice suppliers will ship items to the orphanage. Blockchain technology is applied to all parties in order to be transparent and reduce transaction manipulation.**

Keywords* — *Internet Of Things, Raspberry-pi, Blockchain, Orphanage, Donation

I. INTRODUCTION

An orphanage is a place where children without parents can live under social foundations. Most foundations in Indonesia are funded by donors who manage independently. One problem that occurs is that donors who temporarily live in a place find it difficult to get information about orphanages that are entitled to get help, especially in this case it is about donations for the fulfillment of food reserves where the majority of staple food is rice. Thus, the availability of rice in the orphanage must be maintained and can be easily informed to both, donors and public through a mobile app on an android based communication device. With this easy-to-obtain information, not only donors can provide rice assistance, but also the public can participate in the helping process.

Internet of things is a technology that can provide solutions to overcome problems for donors and orphanages in managing the availability of food reserves. In this case rice is a "thing" that is vital for the survival of the children of the orphanage, however the information must be known and can be forwarded through the network in order to be accessible to everyone. Raspberry-pi 3 as the MCU in this system has the advantages of internal WIFI facility that can be connected directly to the network wirelessly without any additional devices [1]. Raspberry-pi is widely used as an internet of things device, especially on projects related to monitoring technologies such as temperature monitoring, weather [2] or automated home projects and smart homes system [3]. In the proposed system, Raspberry-pi will read the data generated by heavy sensor, which is using a load cell sensor, this sensor detects the amount of rice in kilograms. The data of weight measurement will be send by the device in real-time to the database server located in the cloud and possibly accessed by mobile application on smartphone. Mobile application is intended for three users (Donors, Suppliers, and Providers).

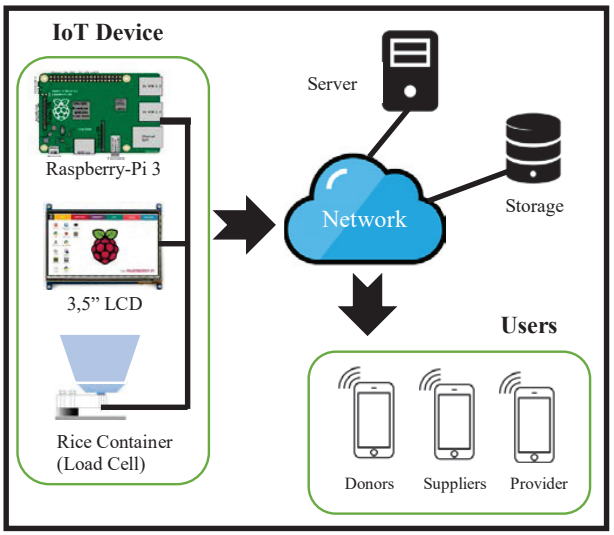

Fig 1. Considered IoT System

The basic principles of the proposed system can be explained on the donor side. Whoever the donor is can find out the lack of rice reserves through applications on smartphones. Donors can find out information through the application by determining how much rice will be send and how much it will cost. The provider side will know about the transactions that occurs from the donor and will ask the rice supplier to send rice to the orphanage. When rice has filled the device at orphanage, it will send notification to the donors, provider and supplier to give the information that the transaction is completed.

II. RELATED WORK

The utilization of load cell in automated system building has been used to measure the maximum load of waste using Arduino through a simulation with stable and optimal results [4]. IoT is a system that must work in real time, load cell has

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been used in research related real time system for measurement of fruits weight using Arduino UNO with maximum system accuracy [5]. Unlike the two studies mentioned above in this study used Raspberry-pi 3 for loadcell acquisition data as well as to connect directly to the network in real time.

Initial research on designing a Node-RED-based mobile app using android using Raspberry-pi 3 was done to monitor and control the device [6]. This research builds an Android-based mobile programming application where people can easily build IoT projects with GUIs without Raspberry-Pi's program and middleware to connect between applications and hardware with special tasks to manage data communications, data streams and device drivers.

Each IoT device should be placed in an orphanage is a peer-to-peer network in which each device will be applied blockchain technology in its transaction process, as did the research [7] where Ethereum as platform blockchain uses smart contract in its transactions.

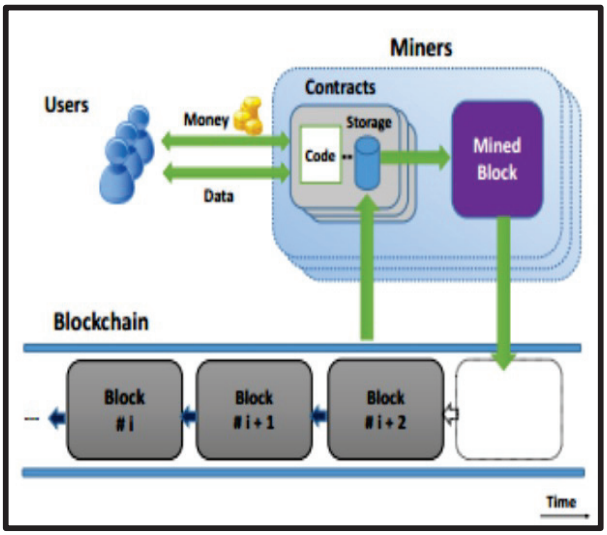

Fig.2 Schematic of a Smart Contracts [8]

Smart contract is a special account with code related to function and data. The code is in an Ethereum-specific binary format (i.e., Ethereum virtual machine bytecode) and propagated by account to a global database known as blockchain. [9]

III. SYSTEM DESIGN

A. *System Overview*

System combined many IoT device that connected to the network therefore have accessibility for three users through blockchain network.

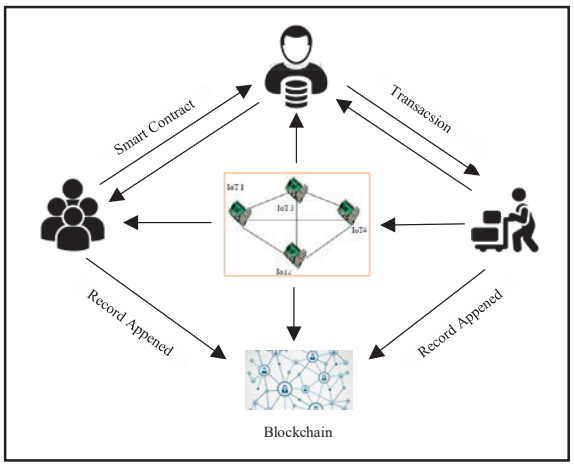

Fig.3 System Design Network

To synchronize the rice stock information to the cloud for advantageous access and further process, the client initially can enrol to the cloud specialist co-op for an online record with enough stockpiling capacity. Figure 3 demonstrates the information gathering and synchronization design from the benefactors, supplier and providers.

The client can impart information to suppliers to look for gift administrations, and with rice stock provider to get a statement for the rice shipping for the shelters. At the point when information sharing is identified in the framework, there will be an occasion produced to record the information get to ask.

B. *System Entities*

• IoT network in an orphanage
Some IoT devices are housed in some orphanages where networks are connected from one Raspberry to another Raspberry information that is mutually open to provide data information of the rice in each orphanage. This information can be monitored by donor and provider sides and recorded in blockchain.

• Database Provider
All data will be stored in the network of database providers. Where the provider will receive a "smart contract" transaction with a donor who will then launch into the rice supplier to enter rice to the orphanage.

• Donors
Donors can monitor every condition of rice weekly and transact with the provider to send some of the rice to the destination orphanages.

• Rice Suppliers

The rice supplier will receive a notification from the provider of the notification from the donor to purchase the rice to the destination orphanage.

• Blockchain Network

This network is designed by utilizing Ethereum and other as transactions, in which every information data in IoT and user transaction data on all sides can be recorded and protected by all parties. The purposes to use this technology is to minimize the data manipulation tby providers, donors and suppliers.

System flow diagrams used can explain how the working principle of the system built.

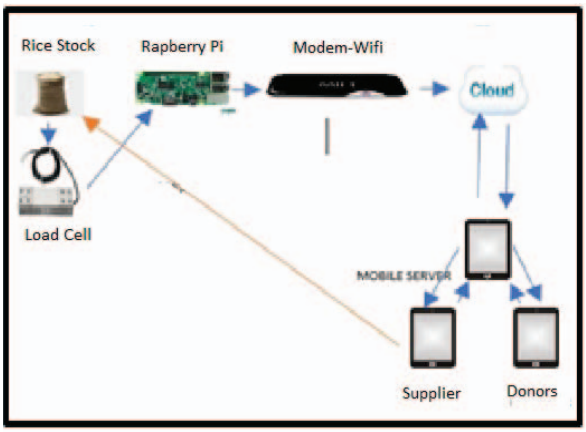

Fig 4. Design implementation

Raspberry-pi is the central controller of all sensors. connected with a heavy sensor, Mi-fi, and mobile. Heavy sensors are useful for detecting the weight of an object which later results will be delivered to Raspberry-Pi Mi-fi is a connection between raspberry-pi connection with internet connected via mobile wi-fi will receive or retrieve information from the internet submitted by raspberry-pi

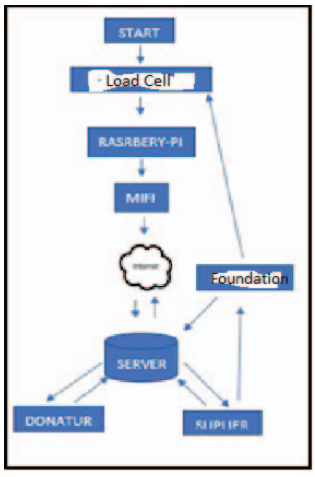

Fig 5. Flowchart

The sensors scale will read the amount of rice stock in the orphanage foundation. When the weight of rice reaches the amount to be specified, then the rice sensor will send a message on raspberry-pi 3. Raspberry-pi will receive messages from the scales sensor and then connect to the internet via Mi-fi, after being connected to the internet raspberry-pi will send a message on the mobile server. The mobile server will receive a message from raspberry-pi which contains the Foundation is out of stock. Then the mobile server will send the information to the donors through the application. After login the donors receive messages from the mobile server then donors will know which foundations need donations. Donors will send donations to the mobile server via transfer. The mobile server will give a receipt to the donator. Mobile server will send information to the supplier to send the rice to the foundation, the orphanages will receive assistance and the foundation will send the message of the mobile server through the application. provider will make a payment to the supplier after the transaction is finished.

IV. RESULT AND DISSCUSION

The system implemented for several orphanages in Sukabumi, West Java. 4 orphanages and 2 suppliers of rice used as raw model, each place has its own IOT device where there is an Indicator which is then informed when a place is experiencing a rice shortage crisis. Blue circle indicator indicates that the reserve stock of rice is still above 0.5 Kg and the red indicator shows the rice is below 0.5 Kg.

Fig6. Orphanage Location

Supplier will dispatch rice to the closest halfway orphanage destination. A donor will get a warning from the IoT gadget when the proposed rice has touched base at the goal and meets the rice compartment. At the point when the rice has arrived, the supplier will keep on exchanging the back to the provider side and give the answer to the donor.

The interface display for each user application designed to support the system.

(a) (b) (c)

Fig7. (a) Provider, (b) Donors, (c) Supplier

Applications that exist on the server include the name of the orphanage and the address of the orphanage that will be discordant, there are notices of red and blue to distinguish which orphanages require donations, and the price of rice in accordance with the supplier so that money donated by donors will be transferred to suppliers according to the price of rice. Any donor who will donate his money must login first after that they can go directly to the main menu where the name of the orphanage and its price list is. Similar to the donor every supplier must login first, then send the rice to the orphanage and provide proof of sending rice to the server.

V. CONCLUSION

In this paper we propose a rice donation system for an IoT-based orphanage where a heavy sensor is placed in each orphanage connected to each other using Raspberry-pi devices. Donors can monitor the condition of foster care when there is an orphanage that lacks rice reserves through an application. Suppliers can send the rice to the destination after the transaction. Smart contract systems between providers and donors using the blockchain network allow all transactions to be monitored and open to make it more secure. By applying the proposed system to 4 orphanages, the results can be established and facilitated the donors.

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