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Automatic Waste Transport Equipment in the River Integrated With the SCADA System

(Supervisory Control and Data Acquisition)

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***Abstract*—Humans use goods and services to meet their daily needs. The number of items used by humans also increases the amount of waste generated every day. Technological developments, industrial developments and the increasing population are factors in the increasing amount of waste, especially plastic waste. The plastic waste crisis in Indonesia has become so acute that the army has been deployed to provide reinforcements, especially to deal with the waste problem in the Citarum River, West Java. In Bandung, Indonesia's third largest city, there are shaking sights of plastic waste so thick that it looks like an iceberg and clogs up a major tributary. This is caused by residents who do not have the awareness not to throw garbage in the river. In addition, the access to garbage disposal around residential areas is quite far away so that residents often throw garbage into the river. With technology, these problems can be resolved and help the process of processing waste in rivers. This technology can clean waste that is disposed of into the river automatically, can sort plastic and non-plastic waste, and can accommodate trash into the trash cans that have been provided around the tool. The technology is called "Automatic Waste Transport Equipment Integrated with the SCADA System (Supervisory Control And Data Acquisition). With the SCADA system which makes the system on this tool more accurate, whether it is in processing the amount of waste data, managing waste disposal, and troubleshooting or when there is damage to the tool, it immediately provides complete and accurate information. So in general, SCADA includes Internet of Things systems, control systems, processing systems and action management.**

Key words—garbage, river, SCADA, technology

I. INTRODUCTION

Garbage, trash, rubbish, or refuse is waste material that is discarded by humans, usually due to a perceived lack of utility. The term generally does not encompass bodily waste products, purely liquid or gaseous wastes, nor toxic waste products [1]. Garbage is commonly sorted and classified into kinds of material suitable for specific kinds of disposal [2].

Increased daily needs of humans affect the amount of goods used and also increases the amount of waste generated every day [3]. Industrial development and increasing population are also a factor in increasing the amount of waste, especially plastic waste [4].

The plastic waste crisis in Indonesia has been so severe that the army has deployed to provide reinforcements, specifically to deal with garbage problems in the Citarum River, West Java (Figure 1) [5].

In Bandung, the third largest city in Indonesia, there is a shocking sight of plastic waste which was so thick that it looked like an iceberg and clogged the creek and tributary [6]. This is caused by residents who do not have the awareness to put garbage in the river. In addition, access to garbage disposal around residential areas are far enough away so that residents often throw garbage at river [7].

To overcome the problem of clogged creek and tributary, and also to help the process of garbage sorting, technology is needed [8]. We have been conceptualize some device that have the ability and features to overcome the specific problems. The device can be called Tributary Garbage Filtering Device with SCADA *(Supervisory Control and Data Acquisition)* Integrated. The device are designed to be filtering the garbage out of the tributary and have a sensor system to split the scrap out of undefined garbage.

The aim of this research is to test the worth of the concept so it can be applied and hopefully become the solution of mentioned problems.

Fig. 1. Citarum river.

II. METHODS

The process of designing the system concept of Tributary Garbage Filtering Device is carried out in several stages shown in Figure 2:

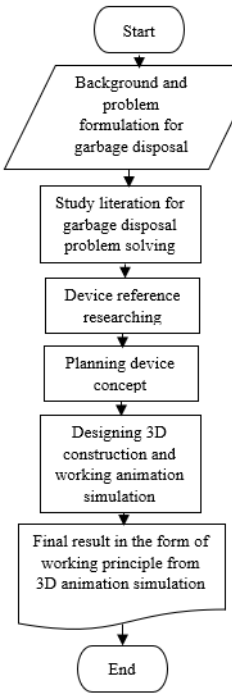

Fig. 2. Concept flow diagram.

A. *Study Literation for Garbage Disposal Problem Solving*

After survey and data collecting at direct site, Cikakak River. literature studies are conducted by searching journals, articles and other media that related with the problems. The studies are needed to strengthen the backgrounds and indicates the solution for problems that exist. Then, the rough image of device features is concepted with the problems as indicators [4].

B. *Device Reference Researching*

Reference of exist developed device related with the goals are needed. at this stage, the base of mechanical construction is inspired by another similar device and used to be adapted to our target resident.

C. *Planning Device Concept*

At this stage, creating the prototype design and simulation based on residents and reference using Solidworks.

D. *Designing 3D Construction and Working Animation Simulation*

At this stage, the concept are visualized to be more advanced with water flow simulation using Blender application.

III. RESULTS AND DISCUSSION

This system works using an AC motor and a DC motor, an AC motor that has been accompanied by a mechanical connection to the wire net will transport garbage from the river to the surface [6]. Meanwhile, the DC motor will deliver the waste to the sorting process. At the time of delivery, it will be detected using an inductive proximity sensor [2]. if it's rubbish active sensor (detects metal waste) cylinder will activate and push the trash into the metal trash [7]. Sensor is not active, then the conveyor will continue to advance to the place non metal waste (Figure 3).

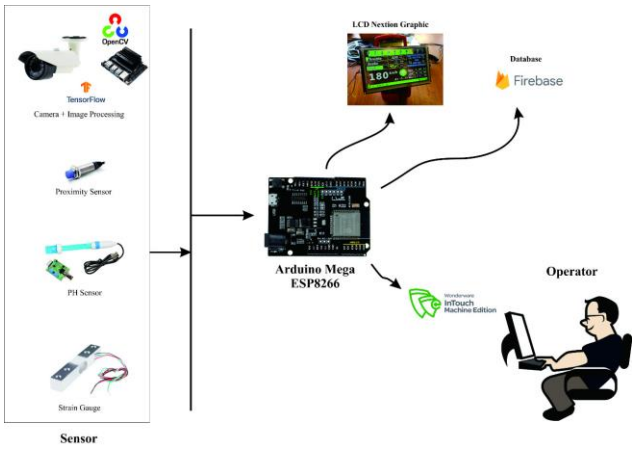

Fig. 3. System overview.

This system allows for the automatic transportation of garbage in the river. In addition, a sorting system is also provided that will sort metal and non-metal waste [3].

This system will send realtime data to the control room. The data includes the PH of water, the amount of sorted waste and indicators of damage [8].

The following is a display on the SCADA system in Figure 4.

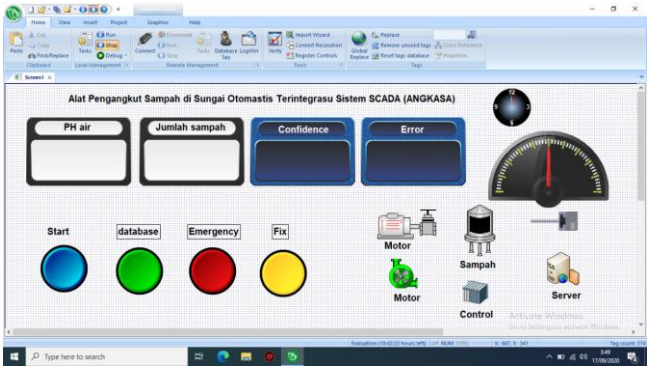

Fig. 4. SCADA view.

The features provided in monitoring consist of several buttons which include the start button, emergency button, fix button and buttons to open the database [2].

In addition, it also provides animation of the amount of waste and monitoring of water PH. if there is a system failure or the trash is full, this system will notify the operator [7]. Operators can come directly to repair or pick up trash from the trash [5].

Fig. 5. System design.

As seen in Figure 5, we created a 3D design using solidword and blender. At this stage, a SCADA simulation is also made using Wonderware Intouch Machine Edition [5]. With the design making, you will see an overview of the mechanical movement and movement of water.

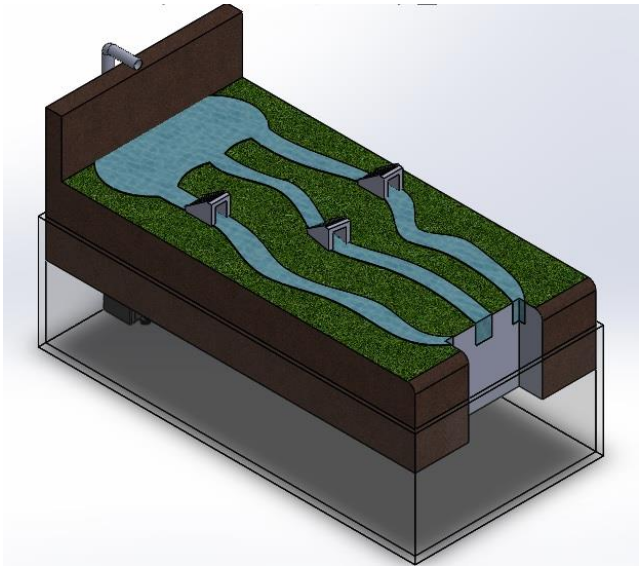

Fig. 6. Designs for three rivers.

Besides being able to be applied to one river, the system can also be applied to several rivers and realtime monitoring is carried out as shown in Figure 6.

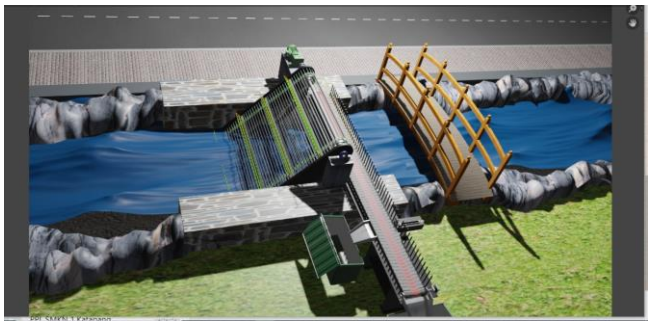

Fig. 7. 3D animation.

This system is also accompanied by object detection using computer vision technology as shown in the 3D animation and shown in Figure 7.

IV. Conclusion

Based on the results and discussion, it can be concluded that the final result in the form of working principle from 3D animation simulation, three phase 380 volts AC powered directly from PLN source, device filtering garbage carried away by river current, sensoring garbage obtained with image processing and conductive sensor, sorting the scrap out of garbage using solenoid thrust, and data acquisition and action controlled by SCADA human interface at the center monitoring and controlling office.

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