Design prototype detection tools of Porous Tree using microcontroller Arduino Uno R3 and piezoelectric sensor

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Abstract. In the city, many trees are found uprooted and cause accidents and many losses. No exception in the area of Majalengka Regency of West Java Province which can also anytime an accident or disaster caused by fallen trees, where in Majalengka district is logging trees on the street and public places are not done regularly. Based on the above problems, the need for tools that can detect a porous tree, to assist in the sorting of trees which should be felled and not felled by the party who has the authority of the general management of BMCK. Previously created tools to detect porous trees imported from Hungary and Germany, namely Arbosonic3D and Sonic Tomography. This design uses piezoelectric sensors to detect how much pressure is received by fragile and fragile trees, of course the fragile and fragile strength of trees will be different when exposed to the same pressure given the fragile density of fragile and fragile trees, then the data sent to Arduino Uno R3 to be processed into an information. This research produces a means of detecting the loss of a tree for early detection and no falling trees.

1. Introduction
Trees have many types, shapes and sizes, the ability of trees to absorb carbon dioxide in the air can improve the quality of the environment and reduce the risk of global warming due to greenhouse effect, therefore tree preservation is needed to support the tree’s growth. Regardless of the many benefits of trees that can support human life, trees can also be affected by disease and or can not grow again because it is old, this condition will cause the tree fell and become a disaster when humans can not maintain it well. The types of damage that causes fallen trees are tree diseases such as cancer, further decay, open wounds, damaged or dead branches, excessive branching or brum and leaves change color. [1]

In trees that live or still stands health conditions are difficult to identify visually so it is difficult to predict whether the tree should be felled or left alive. Therefore, the maintenance of trees for public places is very important, in accordance with the Law no. 26 of 2007 on the arrangement of green open space to create a safe and comfortable area.

The reality in the urban area found many fallen trees and caused accidents and bear a lot of losses. Suara Merdeka media reported in 2016 there are 36 cases of accidents scattered throughout Indonesia due to fallen trees [2]. No exception in Majalengka Regency area which can also anytime accident or disaster caused by fallen tree, where in Majalengka regency for logging street and public place not done periodically [3].
Logging is done in Majalengka Regency only on community report, result from interview with one of general functional part of Badan Marga and Cipta Karya or abbreviated as BMCK, the logging groove in Majalengka Regency can be seen in Figure 1.

![Figure 1. Ground cutting of trees in open fields (general) Majalengka District [3]](image)

2. Methods
Data collection techniques conducted in this study, namely interviews, and literature or documentation studies

1. Interview. Interview techniques are structured or not done primarily to find out the point of view, opinions, information or reality - the reality seen and experienced by respondents and informants.

2. Library Studies. This is done primarily to complement and strengthen the data obtained from interviews. In addition to the theoretical interests, to gain clarity and input on the lateness of the research discussed.

In this system development method writer use Prototype method, Prototype is a method in system development that use approach to make something program quickly and gradually so that can be evaluated by user. Prototype makes the process of developing information systems to be faster and easier. Especially in the state of the needs of the user is difficult to be identified. The image below illustrates the prototype creation process:

![Figure 2. Mechanism of Prototype System Development Method [4]](image)
1) Identification Of System Requirements Customers and developers together define the entire software format, identifying all the needs and outlines of the system to be created; 2) Create a Prototype. Make a prototyping by making design while focusing on the presentation to the customer (eg by making input and output format); 3) Testing. Once the system has become a ready-made software, tested before use. This test is done by testing the tools that have been implanted program Arduino to detect the porous tree; 4) Fixing. The customer evaluates whether the finished system is as expected; 5) Implementation. The software that the customer has tested and received is ready to use.

3. Results and Discussion

3.1. Tree
Understanding the tree according to experts, defines a tree as a group of woody plants, large with a height of more than 5 meters [5]

3.2. Robotics
There are some opinions of robot experts in meberikan definition of robots. Based on several references obtained some definitions of robots as follows [6]. 1) In the dictionary Cannon-Webster robot definition is a machine that looks like a human and performs various complex actions of a human such as walking or talking, or an apparatus that works automatically; 2) Robotic Institute of America was a robot institution at Carnegie Mellon University in 1979 making robot definitions a multi-function and programmable manipulator designed to drive specific materials, devices, or devices through a number of programmed movements to perform certain activities.

3.3. Arduino
Arduino used as a controller on the tool in this study. Arduino is an open source electronic board that has input and output and there is a major component for program controllers that can be written and deleted in a special way that is an ATMega328 based microcontroller chip. Microcontroller itself is a chip or IC (Integrated circuit) that can be programmed using computer. The recorded program aims to enable electronic circuits to read inputs, process and then produce outputs as desired. The result can be a signal, voltage, light, sound, vibration, movement and so on [7].

3.4. Sensor Piezoelectric
Piezoelectric sensors are devices that use piezoelectric effects, to measure changes in pressure, acceleration, strain or strength by converting them to an electrical charge. The piezo prefix - is Greek for 'press' or 'blackmail' [8].

In this study piezo sensor is used to measure the pressure obtained from porous and non-porous trees. Software requirements analysis (Software). This system uses Arduino Uno R3 microcontroller which has been embedded program into it in programming language C. The software needed in prototype of this porous tree detection tool is Arduino IDE 1.6.5, to create program controller system.

In making prototype of tree detection tool from the porous by using Arduino Uno R3 microcontroller and piezoelectric sensor require hardware. The hardware requirements used in making this system prototype are as follows: 1) Arduino Uno R3 Microcontroller as the controller of tree detector from porous to be built in the form of prototype; 2) Piezoelectric sensors as to detect tree porosity seen from vibrations and pressures received by sensors embedded in trees; 3) I2C LCD module is used for as a medium of information for public maintenance officers to provide information of porous or non-porous tree; 4) LED is used as information of porous and non-porous information with different color; 5) Buzzer is also used as information porous and non-porous with different sounds.

In addition to the above hardware, in the manufacture of these systems require additional hardware such as, resistor, jumper cable, button on / off and others. Flowchart of Porous tree detection system:
Figure 3. Flowchart of porous tree detection system

Figure 4. System Chart Scheme
Table 1. Pin-Pin Poisonous Tree Detector Tool

| **Hardware Name** | **Pin on Arduino UNO R3** |
|------------------|--------------------------|
| Buzzer           | Digital 5                |
| LED 1            | Digital 6                |
| LED 2            | Digital 7                |
| LCD 20 x 4+I2C   | Digital 1 & 2 (SCL & SDA) |
| Sensor Piezo 1   | Analog 0                 |
| Button on/off    | Digital 11               |

Figure 5. Prototype of Porous Tree Detecting Tool

4. Conclusion

Based on the results of testing and discussion that has been done, it can be concluded from the final project research on the design of prototype Porous Tree Detection Tool Using Microcontroller Arduino Uno R3 and Piezoelectric Sensors are:

1) The tool is expected to further assist the activities of the authorized part in the maintenance of trees and can minimize the problems that occur due to the porous tree;
2) By doing research and making of this tool hence has been made tool that can detect porous tree using Arduino Uno R3 Microcontroller and piezoelectric sensor;
3) Can know the workings of Piezoelectric Sensors Integrated With Arduino Uno R3 Microcontroller to detect the porous tree by using piezo sensors as the input detection of the amount of pressure that is converted into the number of bytes of the Arduino obtained from the test first, then Arduino will process the data. If > 200 bytes & 600 bytes then declared tree non porous and if > 600 bytes & <1000 bytes then the tree declared porous and Arduino will give command on alarm buzzer, LED, and LCD to give output information.

5. References

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