Embedded System Design Requirement for the Natural Disaster Early Warning System

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***Abstract*—Indonesia is the country with the most volcanoes, meeting many very active continental faults. In addition, the condition of the forest which began to be much deforested, much river siltation and environmental destruction. By looking at such conditions it is appropriate for Indonesia to have an automatic early warning system and can be monitored remotely. One such approach is the application of an integrated Embedded System with a reliable communication system. In the embedded system that is being made, as a processor using the ATMega 328 microcontroller. ATM 328 is an output microcontroller from Atmel which has a RISC architecture where each data execution process is faster than the CISC time operating system and reactive computing implemented in a program structure (using C programming language) in a Main Loop with added functions there are several functions for processing existing raw data sensors, then setting the sensor data format to be ready to be sent to the center control through communication modules. To find out the performance of the system that is made in accordance with the application of natural disaster early warning a trial test or measurement of the main parameter is needed.**

***Index Terms*—Embedded System, design, requirement**

I. INTRODUCTION

Indonesia is the country with the most volcanoes, meeting many very active continental faults. In addition, the condition of the forest which began to be much deforested, much river siltation and environmental destruction. By looking at such conditions it is appropriate for Indonesia to have an automatic early warning system and can be monitored remotely. One such approach is the application of an integrated Embedded System with a reliable communication system.

This research wants to explore how to design, implement and test embedded systems that are suitable for early detection of natural disasters.

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II. GENERAL SYSTEM DESIGN REQUIREMENT

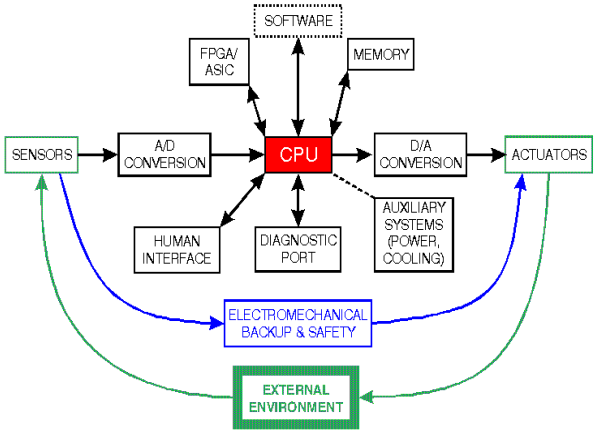

Figure 1. General Architecture for an Embedded System [1]

Figure 1 shows one possible organization or general architecture for an embedded system. In addition to the CPU and memory hierarchy, there is a variety of interfaces that enable the system to measure, manipulate, and otherwise interact with the external environment.

Embedded System typically have tight constraints on both functionality and implementation. In particular, they must guarantee real time operation reactive to external events, conform to size and weight limits, budget power and cooling consumption, satisfy safety and reliability requirements, and meet tight cost targets.

Real time system operation means that correctness of a computation depends, in part, on the time at which it is delivered. Reactive computation means that the software executes in response to external events. Many events may aperiodic, in which case the maximum event arrival rate must be estimated in order to accommodate worst case situations. Design challenges to reduce size, among them, is packaging and integration of digital, analog, and power circuits. Embedded systems have obvious risks associated with failure.

Many embedded systems do not operate in a controlled

environment. The problems can be caused by vibration, shock, lightning, power supply fluctuations, water, corrosion, fire and general physical abuse.

III. The Proposed System

In the embedded system that is being made, as a processor using the ATMega 328 microcontroller. ATM 328 is an output microcontroller from Atmel which has a RISC architecture (Reduce Instruction Set Computer) where each data execution process is faster than the CISC (Completed Instruction Set Computer) architecture. ATMega 328 microcontroller has a Harvard architecture, which separates memory for program code and memory for data so that it can maximize work and parallelism.

For a real time operating system and reactive computing implemented in a program structure (using C programming language) in a Main Loop with added functions there are several functions for processing existing raw data sensors, then setting the sensor data format to be ready to be sent to the center control through communication modules (shield communication modules) including: LoRa WAN, NB-IoT, GPRS, and others. Sensors that will be installed include sensors to detect: floods, earthquakes, landslides and tsunamis. The power system uses a solar cell system.

In order for the embedded system to be designed to have a compact, small and light size, it will be as much as possible to use SMD components and multilayer PCB. In order for a system that is designed to be quite reliable against extreme environmental conditions and also due to noise or other physical disturbances, the PCB design and electronic hardware construction must pay attention to the grounding and shielding systems and other protection properly and correctly. Likewise, the electronic module will be protected with a box or casing that meets the IP (Ingress Protection) Ratings 67 standard which means that it is totally protected against dust ingress and protection against short periods of immersion in water.

IV. DISCUSSION AND Analysis

To find out the performance of the system that is made in accordance with the application of natural disaster early warning a trial test or measurement of the main parameter is needed.

The main parameters are related to whether the real time and reactive operations are as planned. Testing the sensor data is also needed whether the data displayed is the appropriate data and the behavior of the data that can be analyzed or not. Also the communication system is tested whether there is a delay that exceeds the specified threshold limit and so on.

In addition, data collection techniques and data analysis data obtained from measurements must also meet the appropriate statistical methods.

V. Conclusion

It is expected that the system can function with those planned for the detection of natural disasters with careful and planned design.

References

[1] Philip J. Koopman Jr,. Embedded System Design Issues (the Rest of the Story), Proceedings of the International Conference Computer Design (ICCD 96).

[2] Data Sheet ATMega 328