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New Product Developments by a New Combination of Existing Technologies and Open Innovation Strategy: A Case Study of Batteryless Auto Alert Fire Extinguishers

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Today's Contents

- Recently R&D activities in the manufacturing and IT industries are growing more mature and competitive.
- We propose a useful and practical strategy for new innovative product developments with low cost and rapid prototyping
- A real successful case study by combining the existing technologies according to the concepts of "New Combination" and "Open Innovation"
- The world's first prototype system of batteryless smart fire extinguisher
- The product is composed of several existing technologies, parts, modules, and products, including open source software and open source hardware

Literature Review

- New knowledge is created by "New Combinations" of already existing knowledge (Schumpeter, 1912)
- The strategy of "Open Innovation" is so useful and significant for new product developments in these days (Chesbrough, 2003)
- Takefuji and Shoji (2017) explained the function, usage, and history of "Open Source Hardware".
- During a power outage or with dead batteries, in the existing fire extinguishers systems, this expected functionality cannot be achieved *Chubb Fire & Security Proprietary Ltd, 2015*.

What is the background of the product development?

In case of fires, we must not only inform the location to the fire department, but also extinguish the fire as soon as possible.

In existing systems,

- Requires electric power or batteries for messaging the fire department
- Cannot function during a power outage or if the battery is dead
- Battery maintenance is a cumbersome task

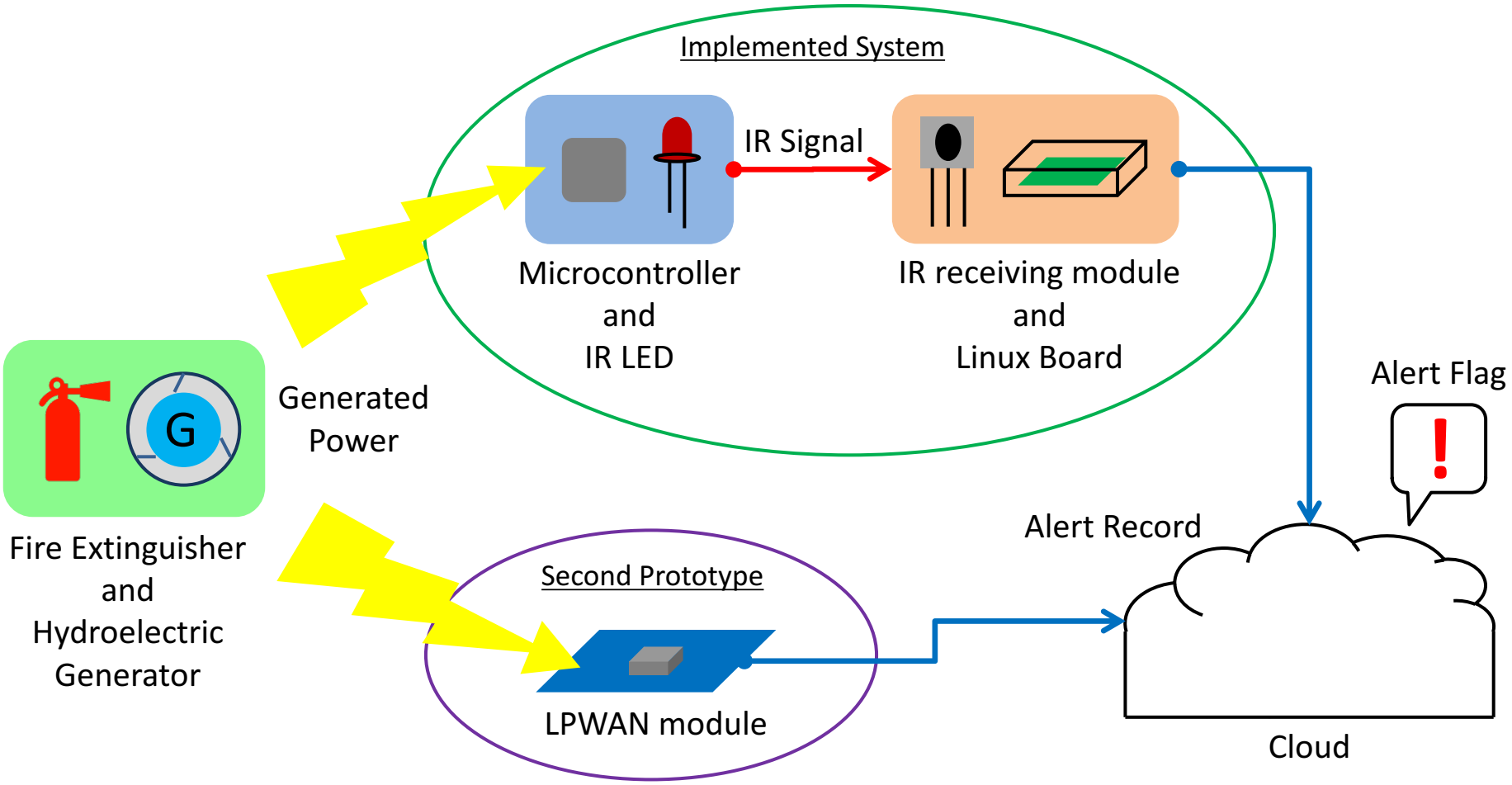
The proposed system :

- A battery-less fire extinguisher with automated alert capability
- Created an innovative prototype using the existing technologies

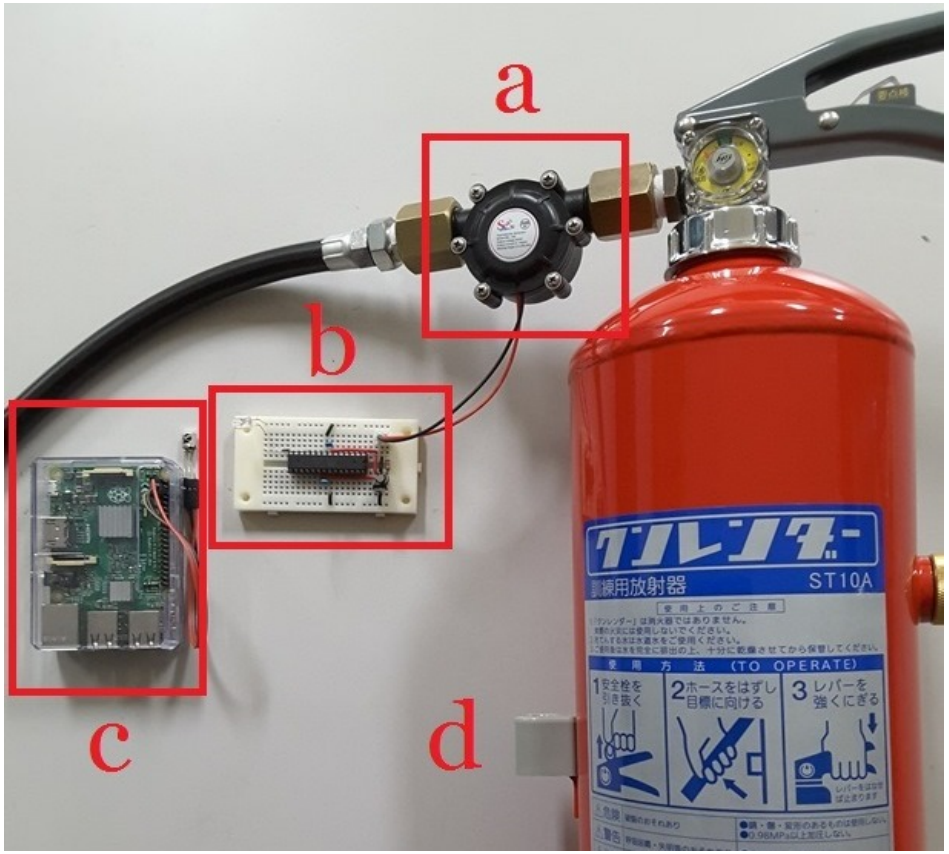
Based on the following technologies:

1. Energy harvesting power generation technology for achieving battery-less system
2. Low Power Wide Area Networking (LPWAN) technology for low power consumption and long distance networking
3. Cloud networking technology for the automated alert capability

Graphical Abstract of the Experiment and the Implemented System



Batteryless Auto Alert Fire Extinguishers



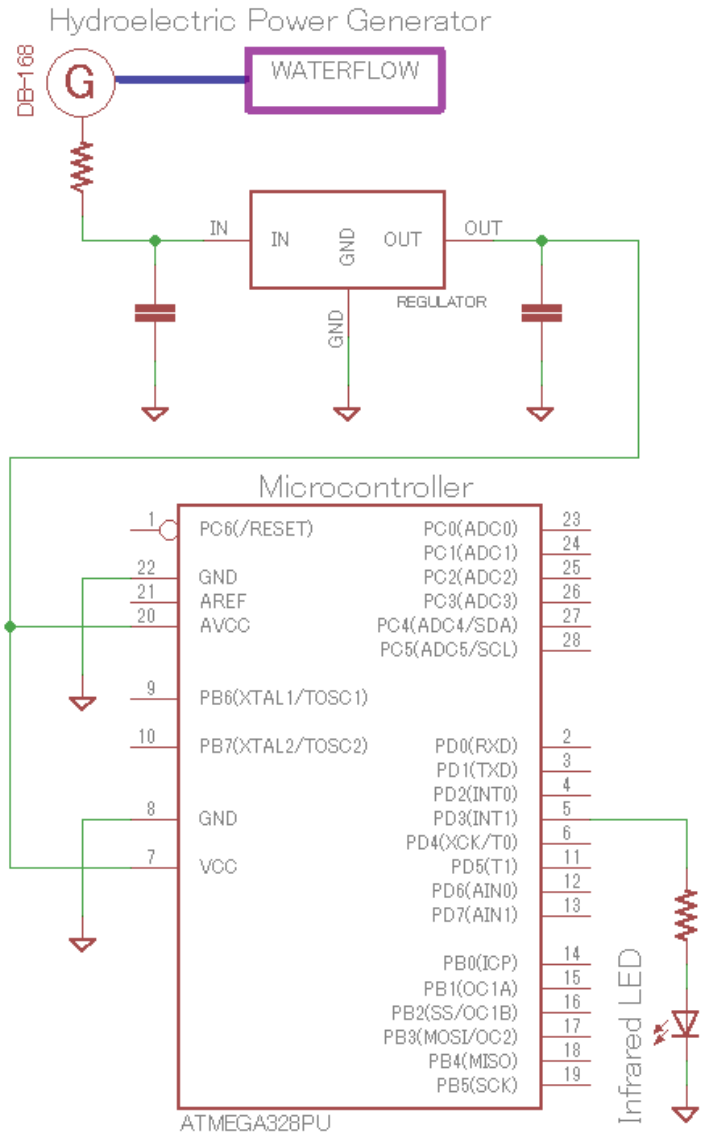
a *Hydroelectric Generator*

b *Infrared Transmitter composed of microcontroller and infrared LED*

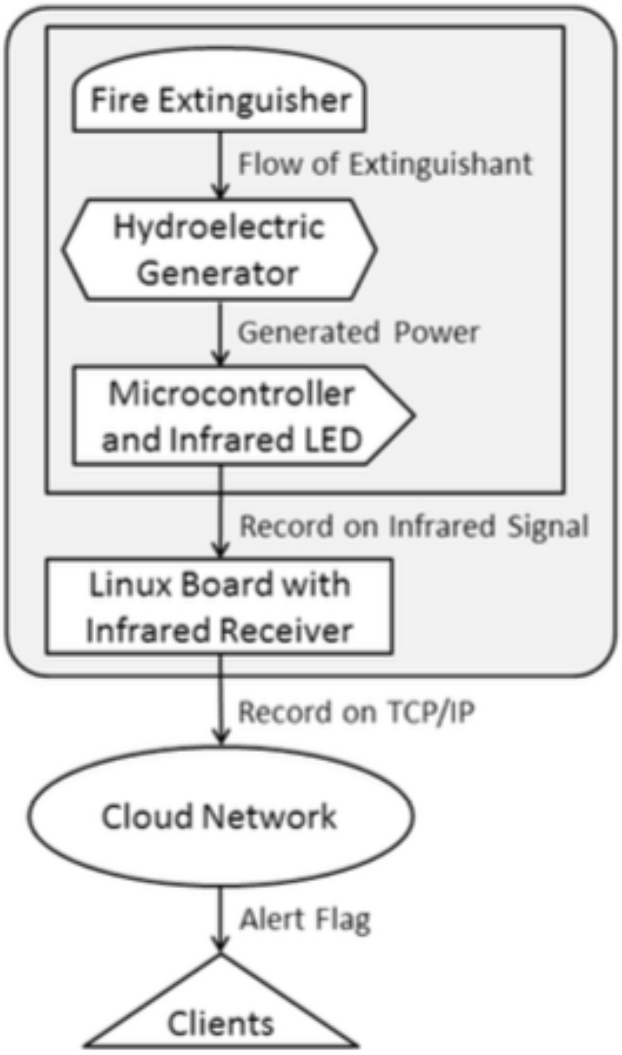
c *Linux Computer Board (Raspberry Pi 2B) and IR Receiving module*

d *Fire Extinguisher (Morita ST10A)*

Circuit diagram of the system



Block diagram of the system



The Result of this Product Development?

- The new system was built using off-the-shelf hardware parts and open source software modules

- Now that batteryless has been achieved,
  - fire extinguishers can be freely installed at any location, and problems with dead batteries are irrelevant
  - no maintenance is required
  - even in severe environmental circumstances or a power outage

- It was necessary to flag the alarm in the cloud network with power generator within this limited time (10 seconds)

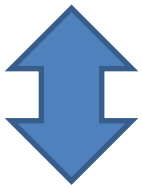
The problem of fire alert with no electric power infrastructure was solved by this experiment.

This is an important contribution to world firefighting.

Closed Innovation VS Open Innovation

In new product developments, closed innovation strategy which uses only owned technologies has high costs and technical limitations.

➔Japanese companies have traditionally followed the closed innovation strategy, although they are trying to change it.



Conversely, open innovation strategy which acquires existing technologies from outside companies and combines them reaches low cost and high speed development capability.

➔The concept of "New Combination" by Schumpeter in the early 20th century is a functional theory even today.

Conclusion

- The proposed system in the paper implied that a new innovative product that was invented from combining existing technologies according to Open Innovation Strategy

- It's a good implication to promote innovative activities of R&D especially for Japanese large companies.