



## SYSTEM AND METHOD TO PREDICT AND CONTROL BLOWOUT IN COMBUSTION SYSTEMS

### IITM Technology Available for Licensing

#### Problem Statement

- Blowout is a severe problem for engines and one of the major concerns in the **power and aviation industry**.
- The **lean fuel-air mixture** in combustion engines where the number of air molecules per molecule is high and causes a significant reduction of the flame temperature inside a combustor near the reactant flame due to the pressure reduction of the flame temperature inside. Such lean conditions make an **engine susceptible**.
- The invention addresses, the lean flame blowout (LFO) problem which leads to **unplanned power outages** and can increase operational costs.

#### Technology Category/Market

- Electronics & Circuits
- Engines & Motors

**Applications** - Aerospace, Power Generation, Defense, Marine, Oil & Gas

**Market** - The Global Combustion Controls System Market size was valued at **USD 131.72 B** in 2021 and is projected to reach USD 196.34 B by 2030, growing at a **CAGR of 4.61%** from 2022 to 2030.

#### Technology

- The invention will predict the **exact time to blowout** in a combustor, which can be several seconds in advance.
- The core of this technology is that, instead of producing another warning method about an impending blowout, it **predicts the time of its occurrence** without using any user defined threshold values.
- It performs the prediction by fitting a **log-periodic power law curve (LPPL)** to the experimentally obtained **time series data** of an appropriate variable such as (but not limited to) fluctuating pressure or heat release rate.

- The observed variable data can be acoustic pressure fluctuations which are measured using a **pressure transducer** such as a microphone or a piezoelectric transducer but not limited to it, or heat release rate obtained from a **photomultiplier or camera**.

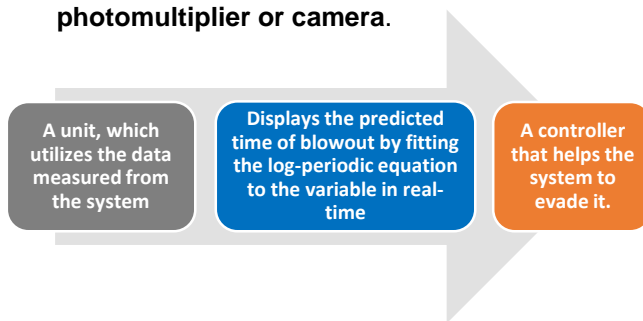


Fig. Graphical representation of this invention

#### Intellectual Property

- IITM IDF Ref. **2321**
- IN 202241007800

#### Key Features / Value Proposition

- This invention requires time series data of a fluctuating variable of the underlying system to find an impending blowout **several seconds in advance**.
- Works on the basis, whether **difference between the predicted time of blowout and the time of the last input** is smaller than the system's response time.
- Control actions include **adjusting fuel-air ratio**, fuel flow rate, airflow rate, secondary injections, turning on a pilot flame.
- Enables **engine downsizing**

#### TRL (Technology Readiness Level)

TRL - **4/5**, Technology validated in relevant environment

#### Research Lab

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Images

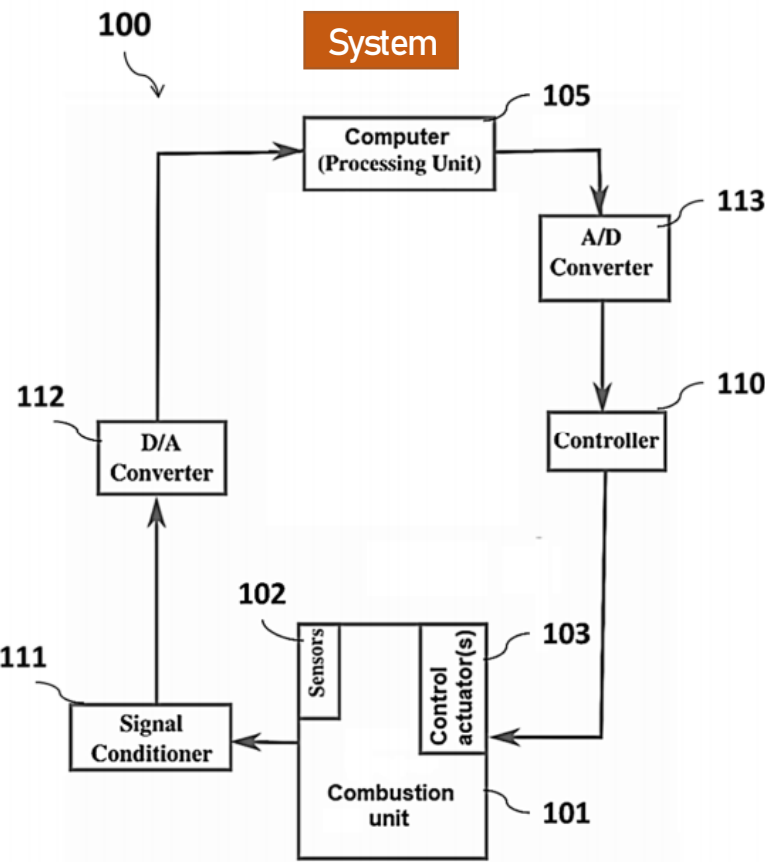


FIG. 1

Fig.1. Block diagram of control unit representing various modules of the prototypical system used for controlling blowout.

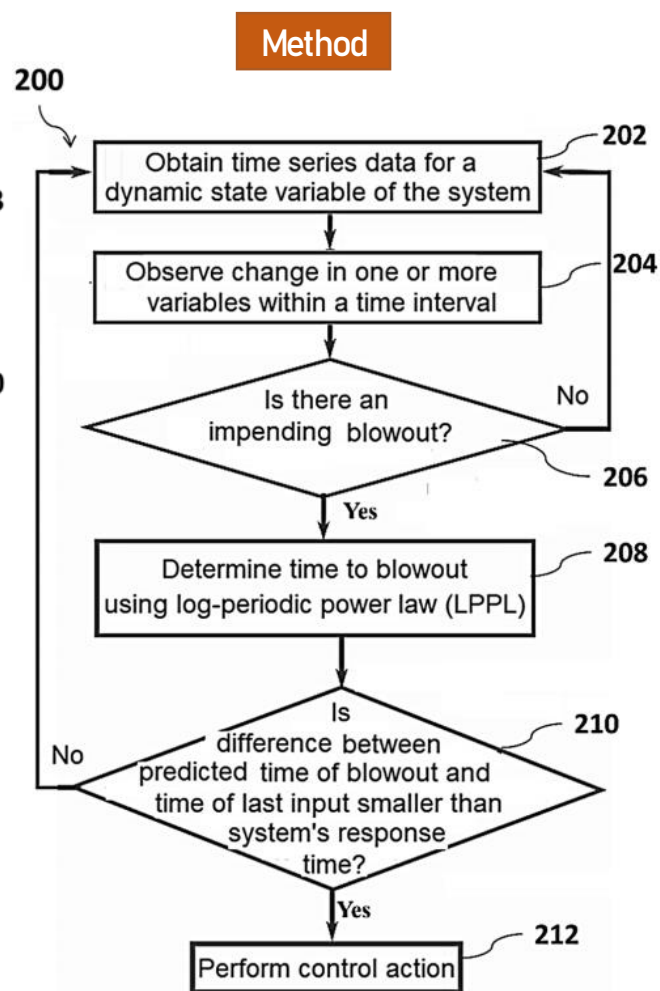


FIG. 2

Fig.2. Flowchart for performing the control action.

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