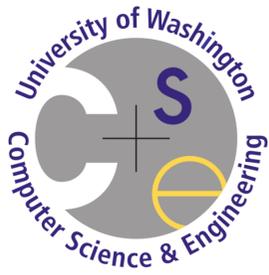


Automatic Trigger Generation for End User Written Rules for Home Automation



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Problem: incorrect triggers

!(State_Away = ON && State_Sleeping = ON)



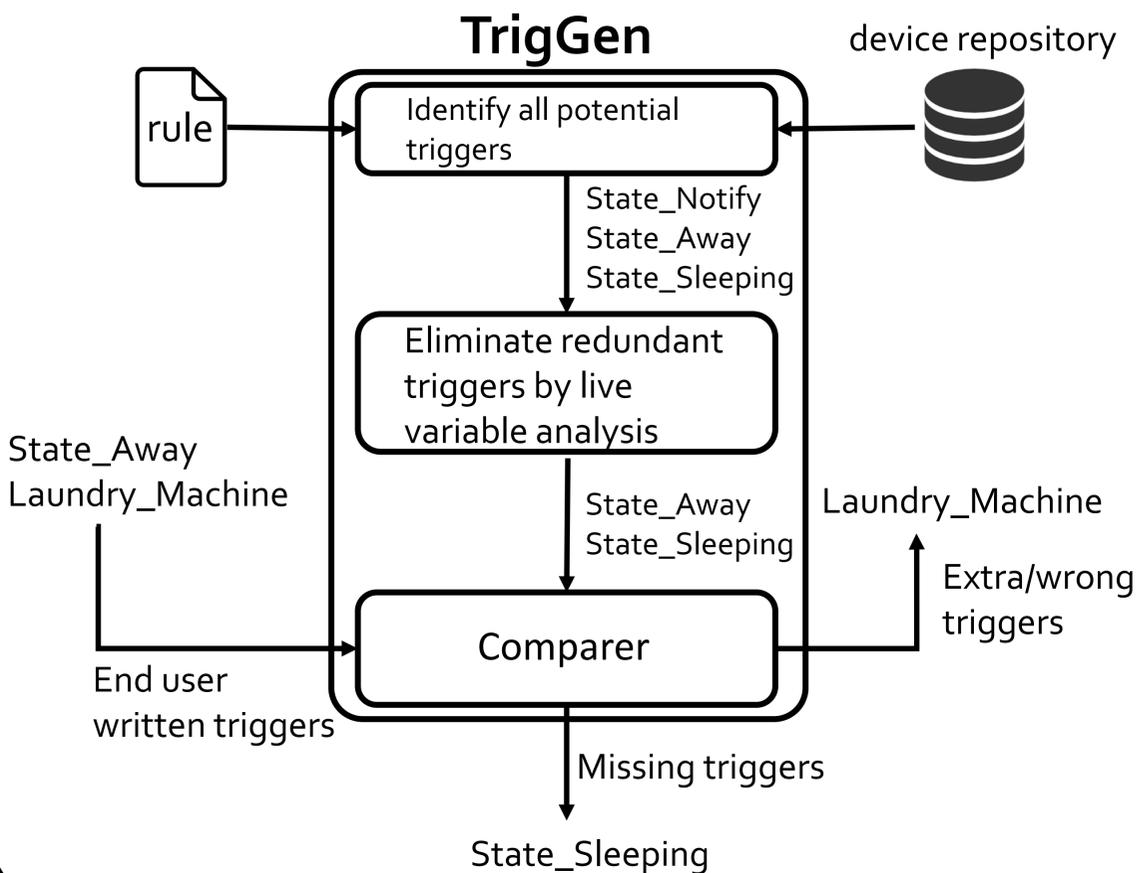
Fails if State_Sleeping is changed to ON after setting State_Away!

```
rule "Away rule"
when
  // trigger block
  Item State_Away changed
then
  // action block
  if (State_Away.state == ON) {
    if (State_Sleeping.state != OFF) {
      postUpdate (State_Sleeping, OFF)
    }
  }
end
```

Solution

TrigGen

- Automatically generate a set of **necessary** and **sufficient** triggers
- Idea: live variable analysis of the action block
 - Live device state: state that is read **before** being written to



```
rule "Away rule"
when
  // trigger block
  Item State_Away changed
  or Item Laundry_Machine changed
then
  // action block
  State_Notify.state = ON
  if (State_Away.state == ON) {
    if (State_Sleeping.state != OFF) {
      postUpdate (State_Sleeping, OFF)
    }
  }
end
```



```
rule "Away rule"
when
  // trigger block
  Item State_Away changed
  or Item State_Sleeping changed
then
  // action block
  State_Notify.state = ON
  if (State_Away.state == ON) {
    if (State_Sleeping.state != OFF) {
      postUpdate (State_Sleeping, OFF)
    }
  }
end
```

Evaluations

- 96 real end user written rules
- Action block size: 1-220 LOC

TrigGen suggested a necessary and sufficient set of triggers	91 (95%)
False positives	0 (0%)
False negatives	5 (5%)
End user missed triggers	77 (80%)

Number of missing triggers detected by TrigGen

