

# Fire Fighter

## Fire Simulation and Extinguishing

Course Project  
CS 684 : Embedded Systems

Team 8

Jeet Patani [10305001] ( Team Leader)

Kaustubh Keskar [10305909]

Anjali Singhal [10305919]

*Under the guidance of*  
Prof. Kavi Arya

# Problem Statement

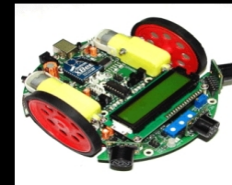
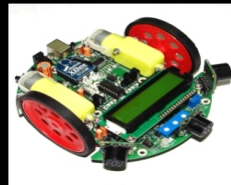
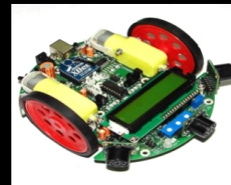
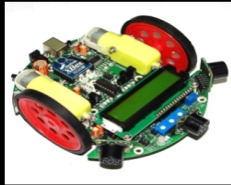
- **Simulate** the real world **fire**. It should **spread** with time.
- **Detect** and **extinguish** the fire.
- Notify to the authorities when the fire is detected.
- Configure the topology dynamically.

# Original Requirements

- **Simulate** the fire using Spark V bots.
- Fire should **spread** on its neighbor bots.
- End the fire when Firebird comes to Spark V.
- **Topology** graph should be **configurable** without change in the code.
- Send an SMS to suthorities when fire starts.
- **Schedule** the movement of the fire fighter such that fire should end.
- Implementation in estereel.

# Final System

**Whiteline Grid**



**Spark V  
Fire Simulation**

**Firebird V  
Fire Fighter**

**GSM Modem  
SMS Module**



# Protocol to simulate the fire.



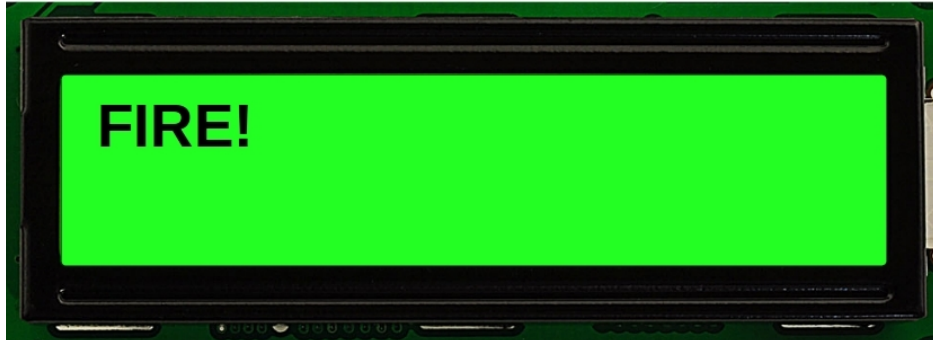
## Possible Types :

- FIRE\_START
- FIRE\_SPREAD
- FIRE\_END
- FIRE\_INIT
- TOPOLOGY

## Collision Avoidance :

- Broadcast all the packets.
- Intentionally back off before sending.
- Avoid collision and byte reordering.

# Indicate Fire on Spark V



Fire Initiated



Fire Spread

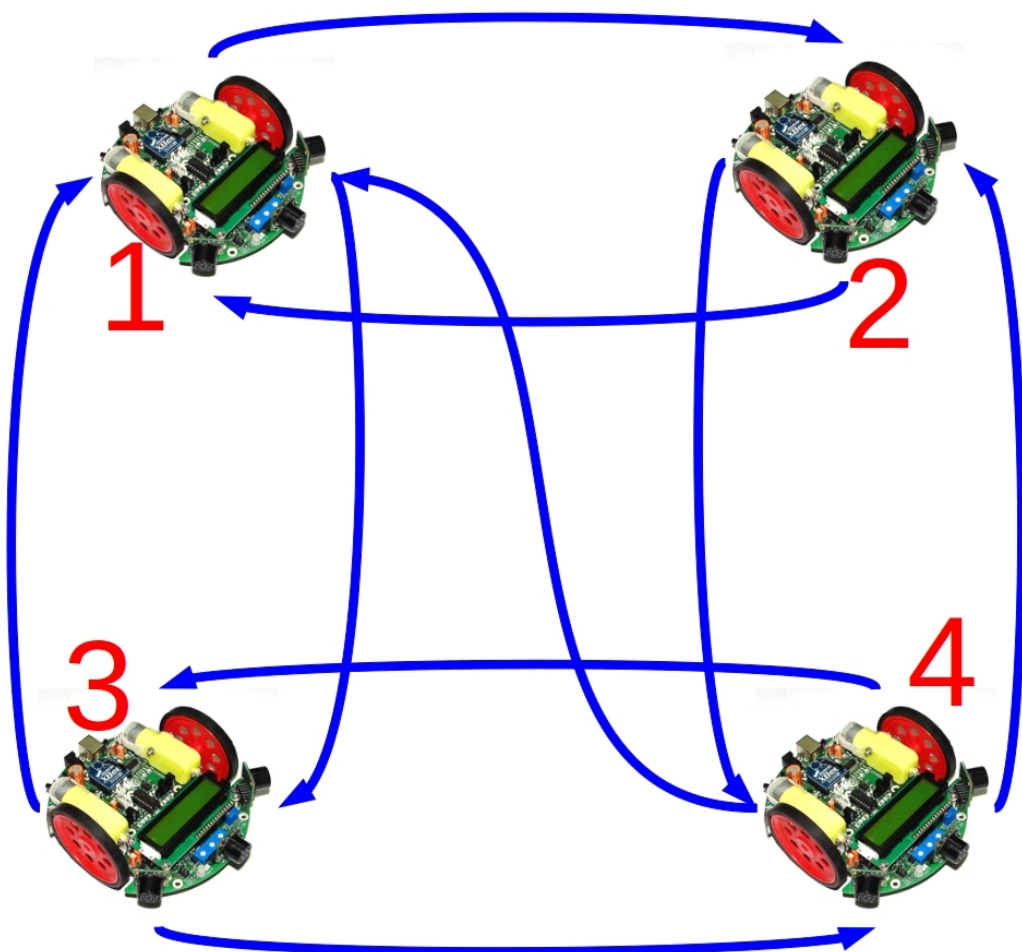


Fire Ended



Topology Configuration

# Topology Configuration


$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

Send **adjacency matrix** from X-CTU.

Broadcast -> All nodes are configured simultaneously.

# Fire Fighter

- Implementation on Firebird 5.
- Send **SMS** when fire starts.
- Maintain a **queue** of the **nodes on fire**.
- Find the **nearest** node on fire.
- Move on **white line grid** from source to destination.
- Stand in front of Spark V to extinguish.
- Maintain current position and direction.



# Problems Encountered

- Motors were not moving with the same speed.
- Problem in rotating to the given degree.
- Start from a white line and stop when white line is detected.
- Problem in Zigbee communication in estereel.
- Ground clearance in Firebird, IR sensors touching the ground in Spark V.
- Thermocol to cover ground clearance.

# Future Work

- **Multiple** fire fighters to cover larger area. **Synchronize** among them.
- **Priority map** to extinguish the fire.
- Functions for specific task has been implemented. Port it to estereel.

Thank you ! :-)

Questions ???