

# Energy Management Systems

Workshop on “Elaboration of active house concept for public buildings”

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# Energy Management Systems

- An **Energy Management System (EMS)** is a system of computer-aided tools used by operators of electric utility grids to monitor, control, and optimize the performance of the generation, consumption or transmission system.
- Also, it can be used in small scale systems like “Microgrids”.
- The computer technology is also referred to as SCADA/EMS or EMS/SCADA.
- In these respects, the terminology EMS then excludes the monitoring and control functions, but more specifically refers to the collective suite of power network applications and to the generation control and scheduling applications.

# Energy Management Systems

## ❖ Questions:

1. Why we need Energy Management System?
2. Why are we talking so much about EMS from last 5-10 years?
3. What are the purpose of it?

## ❖ Answers:

1. For effective and reliable utilization of various energies. (i.e., Electric, Heating, Colling, etc.)
2. Rapid expansion in demand of Electrical Energy. (I.e., New electrical/electronics equipment, EVs, etc.,.)
3. Reduction in use of fossil fuel and degradation of  $CO_2$ .
4. Renewable Energy (Intermittent type of Energy)
5. Automation for saving time and human effort.

# House/Building Energy Management Systems

- **House/Building energy management system (HEMS/BEMS)** is a computer-based control system installed in buildings.
- BEMS integrates the monitor and control of mechanical and electrical systems within a building into an overall control and optimization strategy related to energy, occupant comfort, etc.
- BEMS also gathers, analyses and controls building performance data such as temperature, humidity, levels of carbon dioxide, room illumination, etc., of various places in a building. BEMS's components are generally laid out in a four-level system:
  - Sensors, switches, etc., at the field (equipment) level
  - Outstations and discrete controllers at the control level
  - Operation station with a computer-based control system at the operation level
  - Central station communication via gateways at the management level.

# House/Building Energy Management Systems

**A list of systems that can be monitored or controlled by a BEMS are shown below:**

- Illumination (lighting) control
- Electric power control
- Heating, ventilation, and air conditioning
- Security and observation with automation
- Access control
- Fire alarm system
- Lifts, elevators etc.
- Closed-circuit television (CCTV)
- Other engineering systems
- Control Panel
- Public Address (PA) System
- Alarm Monitor

# House/Building Energy Management Systems

- **Many benefits exist when a BMS is installed in a building, some of them are:**
  - Possibility of individual room control
  - Increased staff productivity
  - Effective monitoring and targeting of energy consumption
  - Improved plant reliability and life
  - Effective response to HVAC-related complaints
  - Save time and money during the maintenance
  - Occupancy sensors allow automatic setback override during unoccupied periods as well as adaptive occupancy scheduling.
  - Lighting controls reduce unnecessary artificial lighting via motion sensors and schedules as well as by controlling daylight harvesting louvers
  - Controllers save water and energy by controlling rainwater harvesting and landscape irrigation

# House/Building Energy Management Systems

- **Many benefits exist for building managers:**
  - Higher rental value
  - Flexibility on change of building use
  - Individual tenant billing for services facilities time saving
  - Remote monitoring of the plants (such as AHU's, fire pumps, plumbing pumps, electrical supply, STP, WTP, greywater treatment plant etc.)
  - Ease of maintenance
- **Benefits for maintenance companies:**
  - Ease of information availability
  - Computerized maintenance scheduling
  - Effective use of maintenance staff
  - Early detection of problems or service work easy
  - More satisfied occupants



# House/Building Energy Management Systems

- **BEMS**, in its most recent form, benefits from advanced development of intelligent/smart technologies and communications, such as wireless technologies.
- These technologies empower BEMS to extend its scope, such as optimizing energy efficiency through interoperable services and dynamic control of multiple equipments and technological systems.
- Other advanced approaches include communication among sensors, context-aware, user-adaptive, prioritization of information, etc. (European Commission, 2009).
- For example, lighting sensors from a room's daylight system can send signals of overcast sky to BEMS.
- The system then analyses data from motion sensors installed in the room to detect whether the room is in use, in order to decide to whether to automatically switch on supplemental artificial lighting.
- Such data are also used to determine whether air-conditioning in that particular room should be turned off or remain to be on.

# House/Building Energy Management Systems

- Building management systems are most commonly implemented in large projects with extensive mechanical, HVAC, and electrical systems.
- Systems linked to a Building management systems typically represent 40% of a building's energy usage; if lighting is included, this number approaches to 70%.
- Building management systems are a critical component to managing energy demand.
- Improperly configured BMS systems are believed to account for 20% of building energy usage.

# Features of Energy Management System Application

- Automated, Manual control
- Electricity operator control for Maintenance or holiday features
- Smart plug control
- Daily, Monthly and yearly metering of Electricity and consumption and generation from renewables.
- Battery status indicator
- Auto control for utilizing electricity from grid and home storage
- Automatic light dimmer control according to sun rays
- Time schedule control
- Group switch control

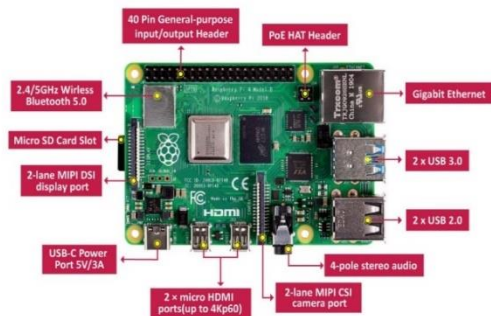


# Features of Energy Management System Application

- Worldwide control
- Control of Electric Energy, Heating Energy, Cooling Energy
- Two-way communication flow ( i.e., Sensing temperature and according to that send turning ON/OFF command)
- Obey the rules of IOE (Internet of Electricity)
- Smart lock control
- Block chain security control or transferring data
- Big Data Technology
- Two-way communication between electricity operator and home application
- Direct communication with smart meter
- Alarm control in case of emergency (Police, Ambulance and Fire Van)



# Controller Development



Raspberry Pi 4B



Arduino AT Mega 328



Touch Screen  
Monitoring Display



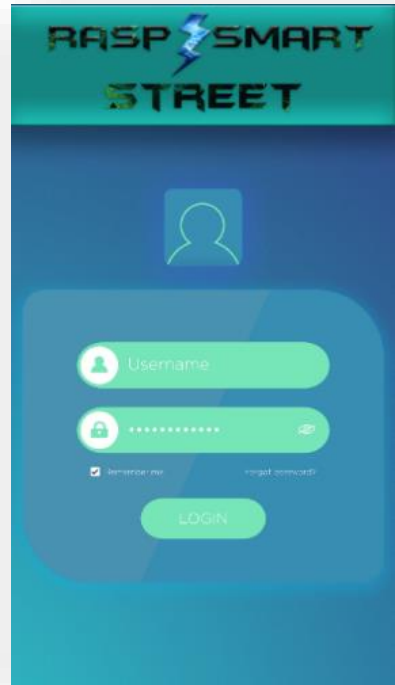
Sensors

## Home Automation Kit with Application

- Raspberry pi 4 version with 4 GB RAM and Arduino AT Mega 328
- 32 GB MicroSD card
- 15 Watt power full charger
- 7" inch Display
- Home Area Network
- Various Sensors
- Power Electronic circuit

## Development of Application:

- Web Application, Mobile Application, PC Application
- Java/Python/C++ environment for development
- Communication using Internet (Wifi)



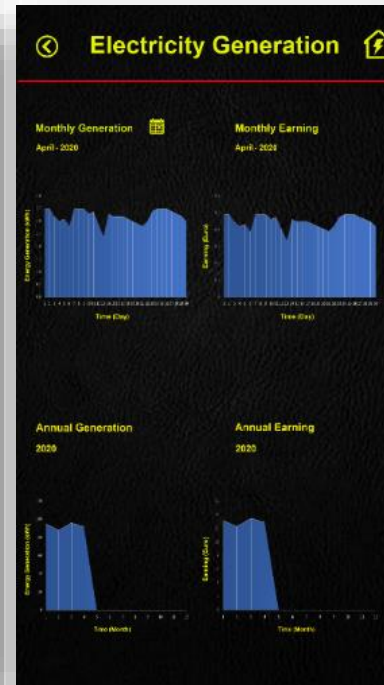
Login Page



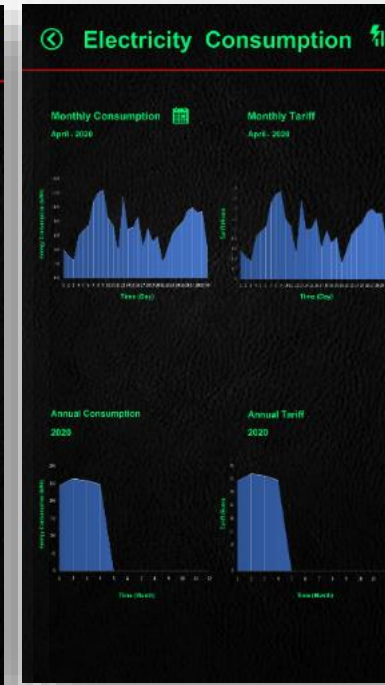
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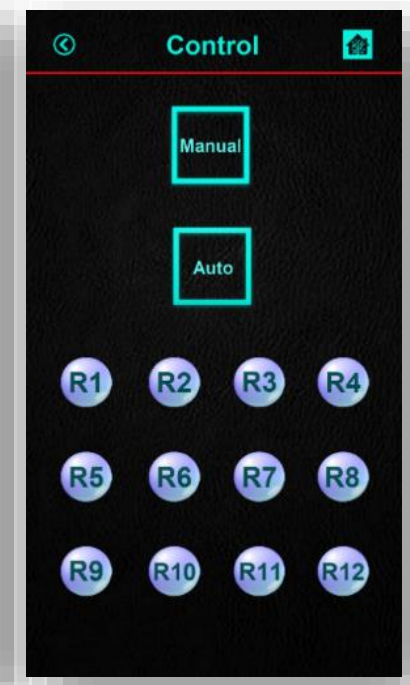
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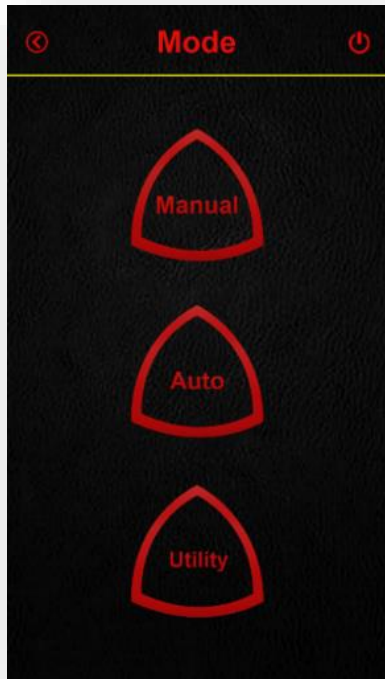
Electricity Generation



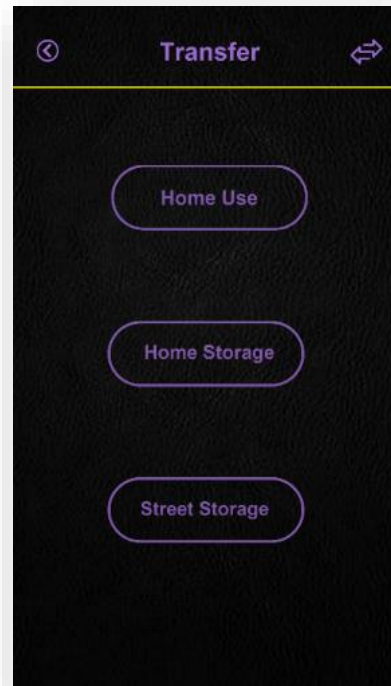
Electricity consumption



Control



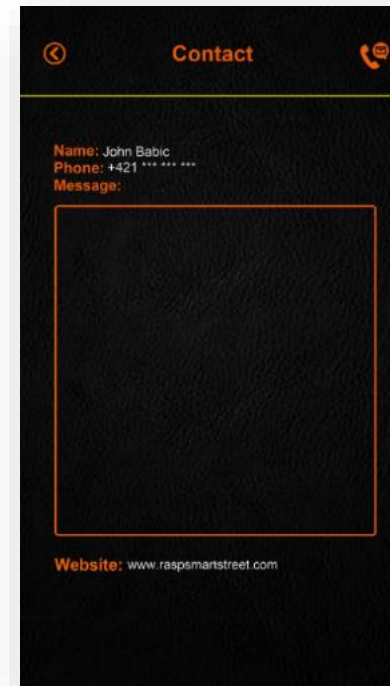
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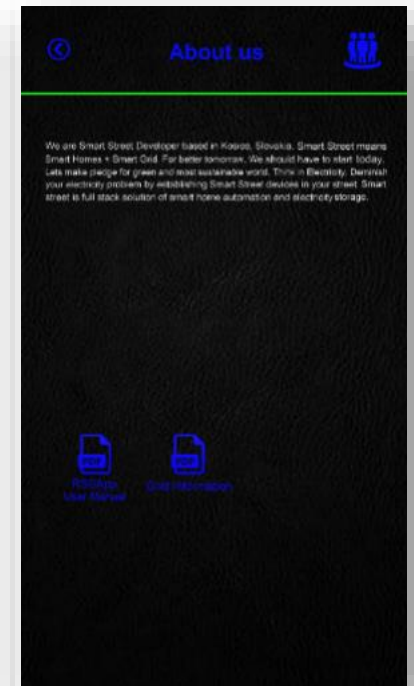
Transfer



Alert!!!



Contact



About us

Any Questions?





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