Smart Catcher of weighted Objects

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Abstract. At present, there is no solution whenever a live person or live animal was fallen from a building or from a high tower. To safeguard the live person, an IoT based adapter to be built whose purpose is to catch the object when a heavy movement is detected in the air. Any building from which a weighted object is dropped, that can be caught by netted sculpt that can get information from the proposed IoT based adapter fixed at someplace at the side view of the building. The components of this smart catcher are catcher device as IoT based adapter in which accurate position is predicted, netted wire with a built-in chip that takes location from the previous module, and catch the weighted object by the netted wire that can be directed by the built-in chip of it, and brings that object to the ground. Hence, the proposed methodology is the interconnection of networked devices that will communicate with each other in order to save the lives or any object that gets dropped from someplace of the high building. Its main advantage is eco-friendly nature and the latest technology adapted to figure out to catch the object that was falling from a remote high place. The sensors of the IoT-based adapter will scan and works to catch whenever the movement of the weighted object is detected. That sensed information to be sent to the chip of netted wire and netted wire will point to an accurate location to catch the object. The result is stored in a report that could be communicated to the nearest office.

Keywords: automation, IoT, GPS, weighted object, chip and eco-friendly.

1. Introduction
Nowadays, many people are dying due to a lack of management of their stress or many external factors that affect directly or indirectly. When they have planned to die, one of the options they choose is to jump in a river from a bridge or jump from a high building. The reasons may fall into many cases like the unbalancing of life, personal problems, teasing from society, a disorder in their behavior and more sensitivity, and many other factors that may influence the people to suicide. Because of the lack of monitoring and manual approach failure, it causes an automatic approach to safeguarding the lives. Many people are unnecessarily leaving this world although there is a scope to stop these kinds of issues. Because of technology development, it is possible to save the lives of the people when they select to jump from a high apartment or from a bridge over a river or canal. Here, one factor is
considered that shows the sudden movement of a weighted object that satisfies a particular weight. Based on the motion of the object in the free air, the movement sensor in the IoT based adapter will be invoked and sends the exact location to the netted wire with a built-in chip in order to catch the object. The chip in the netted wire will make the net to go to a particular location that is guessed and will get support from the environment in which elastic kind of wires are used that attaches to the walls of the building or the pillars and base of the flyover/bridge. After catching the object and information such as the status of the object is propagated to the nearest controlling station in a voice sentenced text. The agenda of this title is to save a life but not thinking about pitfalls and technology required to implement the concerning ideology.

2. Related Work
In this study, there were few works identified and are listed in the references along with their short comings. They were not helped to reach the proposed ideology of our work. There are many studies but they are related to other kinds of applications. According to [1],[2], the study is on catching of fish, the prototype and ideology is designed in order to catch the fish using the appropriate net. With respect to [3],[4],[5] and [9], the ideology described by these studies are design related to catching the eggs, farming of eggs and chicken, catching the chicken using a movable truck, the system that visualizes the loading of chicken into the cargo respectively. In studies [6],[7] that describes about the device that catches poke-mon type objects into a pocket and is available in online shopping stores, and catching of poke cords. In studies particularly done in [10],[11][,12] and [13] describe the various ways and modes of catching the objects by robot and using its arm. These studies are limited to few objects to catch but not all and also the arm will catch only if the object is directed towards the robot. In [14], there was a study on estimation of point of time and estimation of robot arm to catch at that time based on several experiments and explanations. In [15], there were questions and answers forum that discusses the approaches and methods to catch the objects. In [16],[17], the fMRI work happened on the role of cerebellum and its processing for feed forward approach. In [18] and [19] works, the scope is limited to making decisions using Gamma and recognition of plate using mat-lab GUI respectively but not explained on how to catch the object with more accuracy. In studies [20] and [21], the descriptions defined are one in which GPS enabled devices with limited speed for electrical vehicles and other is for data collection and recovering to fulfill the complete IoT based applications respectively. In [22] and [23], the studies in which first represent about jitter spectral shaping system using oversampling techniques, and the second denote the manner of designing the pedestrian subway system is defined and explained respectively. In [24] and [25], the studies summarizes in which one is about wind effect on specified shaped building using influent, and other is on optimal scheduling for an electrical vehicle respectively. In studies [26] and [27], one states that detecting the cycle paths and slips in certain observations and other is on a new technique that safeguard the data stored and collected in Integrated IoT application respectively. In works mentioned in [28] and [29] in which first specifies that making accurate alerts for each appointment made by the user and second is on detecting faults in transmission of data using specific approaches. In [30], the discussion is done on various ways of trajectory paths to be used. In [31] and [32], the studies represent about Hybrid context aware for pervasive smart environment and its consequences is discussed is as one, other is about on smart emergency responsive environment for fire hazards using IoT and its consequences are discussed. In [33] and [34] states that one is on THAM index for agriculture decision making using IoT and other is on specific nano-tube arrays for sensing acetone room temperature and their implications. These are although different w.r.to application, the terminology IoT is useful in our proposed application. All these studies discussed so far are some way of catching object in different applications and explanations and experiments about catching through specific
techniques and by robotic arms.

3. Proposed Work

This proposed method consists of modules such as IoT based adaptor, chip oriented netted wire, and status of the resulted information to be passed to the controller of that situation. The features of IoT based adaptor is described first, later the architecture is demonstrated and the pseudo code is explained in terms of working and connection of the components.

The study called smart catcher consists of the following modules or components identified:

a) **IoT based adaptor**: This is first and important component involves movement sensor and Mass sensor. These sensors will be notified when certain weighted object is falling in the air surface in which weight by mass sensor and falling is by movement sensor. Whenever that is identified, that can be sent to the next component named built in chip netted wire. The activities involved in this module are identifying the object, predicting the trajectory of that falling object to hit the ground, predicting exact location to catch it before hitting, predicting also time elapsed to catch it, and provides these as input to next module called netted chip in order to proceed further.

b) **Chip oriented netted wire**: It gathers location of the object from the IoT based adapter, and makes the net be available on that space to catch the object. Here, the built in chip directs the corners of the net to get support from the walls or from the available surface. The routing considered here is dynamic routing and shortest path routing is used to catch the object. The activities to be performed in this module are taking input from previous module, which netted chip to be reacted to catch the object, spawns the net to the estimated point in the travel time of the object, and all these statistics are stored in a report and sent to nearest communication center or registered communication device.

c) **Output Oriented Gadget or Communication Center**: Once the object is caught, the status is to be sent to the controller where output gadget will receive and produce that information as a voice message. The activities included are getting report from previous module and stores the reports in the cloud.
In above architecture, what are the modules involved and what activities are performed by the each module is specified in terms of use cases.

The working methodology is also defined in the pseudo procedure. The pseudo procedure for smart catcher is defined as below:

Pseudo Procedure Smart_Catcher(Environment, object):
Input: Identifying falling object
Output: Statistics in a report
Step1: Calls IoT based adapter(object)
1.1 predicts the object in the permissible area
1.2 finds the type of trajectory automatically
1.3 finds the time
1.4 finds the location to catch the object

These activities are represented in a flow graph in order to estimate many factors that are useful to capture the falling object:
Fig. 2: The flow of activities in IoT based Adapter
Step 2: Calls the Netted Chip (trajectory, location, time):

1. Predicts the nearest supporting walls or stalls to get support, determine the number of points required to get proper support
2. Take support by sprawling the corners and opens the net at point of location estimated before hitting the ground
3. Follows the timing and catch the object
4. Prepare a report that consists of statistics required to catch the object.

These activities are represented in the following flow graph in order to catch the object using the inputs taken from previous module and generates a report that consist of statistics of catch up details of an object.

Fig. 3: The flow of activities in Netted Wire with built in Chip
Step3: Communication Device(report):
   3.1 Stores the report for knowing the information such as time taken to catch, location predicted to catch and best trajectory used
   3.2 Maintains the evolution of the reports in a cloud for future analysis
These activities are presented in an easy understandable flow graph and is defined as follows:

Fig.4: The flow of activities in Communication center

The flow of modules interaction specifies the working methodology of proposed ideology where the activities are already defined for each module in Fig.1. The following diagram shows the flow chart of proposed work.

Fig.5: The flow chart of Smart Catcher

The style of working is discussed through architecture, pseudo code, and also by flow chart. The clear view of the proposed work to be known in a better manner using results chapter.
4. Results
In this, the input and output for the modules described in the theme of this ideology were described here. The flow of data from one module to another module describes the results obtained at each stage of this architecture.

In traditional methodology where an object is falling, it takes more time to save the life and catch the object when the object is somewhere stuck between the building and the ground. The traditional approach fails when to save and catch the object instantly. Hence, the alternative considered is smart catcher where few modules based on IoT works well and will achieve the goal accurately than traditional and other robotic models.

The kind of outdoor sensors used are listed as follows:
Step1: One sensor having the following specifications and has a range of supporting 18 meters.

![Fig.6: Sensor proposed for IoT based adapter](image)

**C-Bus 110 Degree PIR Occupancy Sensor:**
Features:
- Uses PIR technology for accurate detection
- Supports up to range 18 meters
- Completely water and dust proof
- Supports broader areas

The other sensor with the range of 30 meters range and has the following specifications:

![Fig.7: Another Sensor proposed for IoT based adapter](image)
Wide Range PIR Sensor:

Features:
- Uses PIR technology for accurate 360° detection
- Supports up to range 30 meters
- Completely water and dust proof
- Supports open spaces
- Supports multiple output modes and remote control options.

Step2: When the object is falling from top of some height from the side of the building, the sensor discussed in step1 will be activated and predicts the trajectory, location, and estimates the time to reach the ground so that it fixes the time to catch the object in between.

The objects could be as follows:

![Various ways of falling of objects considered](image)

Fig.8: Various ways of falling of objects considered

The output of first module is the following report. It( means IoT based Adapter) generates a report on falling object:

![IoT based Adapter report](image)

Fig.9: Various factors are recorded in the report

Step3: The netted wire chip is designed in such a way that receives the output from the outdoor wide sensor and triggers the net by following the time and estimated location by taking few supporting points on a building in which it is installed.
Fig. 10: Netted wire with NET HEADS

Step 4: The statistics to be recorded and is sent to communication device or nearest communication centre. The report looks like as follows:

| Smart Catcher: |
|----------------|
| Object type identified: Bar |
| The amount of distance it is far from the ground: 12 meters |
| Object's speed: 4 meter/ sec |
| The amount of time taken to catch the object 5 sec |
| The number of supporting points taken is 5 (N, E, W, S) |
| Trajectory type considered is Parabolic |

Fig. 11: Final report statistics

The performance of this proposed ideology is far better than any other kind of approaches in terms of accuracy and in quicker time.

The following graph demonstrates smart catcher over traditional and standard approaches where accuracy is more and less time taken to catch the object.
Comparison of Smart Catcher (proposed) and Standard Approaches based on time and accuracy:

Where proposed approach smart object catcher will take less time and more accuracy and is automatic and is going to run on power and is internet enabled. The other category differentiated here is standard approach in which more time taken and more accuracy will be there and is human dependent and require external resources and communications to handle the situation.

5. Conclusion
In this, primarily focused on small scope where a weighted object if falling is detected, activates the designed sensor. That sensor will find the location of the weighted object, direct the chip oriented netted-wire is made on and will throw the netted wire to catch the object. Once the object is caught, the information about it is generated in the report that will be sent to the nearest communication center to which it is registered. In the future, this ideology is extended to a larger scope of area where objects to be caught at the bridges over oceans and similar applications on this kind. At present, this ideology is demanded and is expecting great demand for future generations. Here, the distance range sensor and capturing sensor were designed and were useful not only in this application but also in other applications.
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